

ADDENDUM NO. 03

PROJECT: **VIGO COUNTY SECURTY CENTER**
Terre Haute, Indiana 47807

TO: All Prospective Bidders and others to whom Plans and Specifications for the above referenced Project have been issued.

OWNER: **VIGO COUNTY BOARD OF COMMISSIONERS**
650 South 1st Street
Terre Haute, IN 47807
812.231.6200

ARCHITECT: **DLZ INDIANA, LLC**
157 East Maryland Street
Indianapolis, Indiana 46204
317.633.4120
DLZ Project Number: 1663-1190-90

**CONSTRUCTION
MANAGER:** **GARMONG CONSTRUCTION SERVICES**
3050 Poplar Street
Terre Haute, IN 47803
812.234.1403

DATE: **SETEMBER 26, 2019**

The items included in this Addendum are to become a part of the original Contract Documents including Drawings and Project Manual dated September 05, 2019 as if included herein. Only these items are to be altered. The remainder of the original Drawings and Project Manual remain valid in their entirety. Bidders must acknowledge receipt of this Addendum in the space provided on the Proposal Form. Failure to do so may subject the Bidder to disqualification.

PROJECT MANUAL – VOLUME 1

ITEM NO. 1. TABLE OF CONTENTS

- a. Added the 013310 - CADD Information Request Form
- b. Added the 033616 – Reactive Chemical Stain

ITEM NO. 2. Section 011200 Multiple Contract Summary

- a. Replace Specification Section 011200 Multiple Contract Summary in its entirety with the attached.

ITEM NO. 3. 013310 - CADD Information Request Form

- a. Added the 013310 - CADD Information Request Form

PROJECT MANUAL – VOLUME 2

ITEM NO. 4. SECTION 033000 – CAST-IN-PLACE CONCRETE

- a. Section 2.3.A.1.c. REVISE to read “Portland Cement: ASTM C150/C150M, Type I.”

ITEM NO. 5. SECTION 033616 – REACTIVE CHEMICAL STAIN

- a. Added this specification section.

ITEM NO. 6. SECTION 042113 – BRICK MASONRY

- a. Section 2.2D.2 thru 6. "Thin Brick" revised and added these sentences to this section.

ITEM NO. 7. SECTION 071326 FL – SELF-ADHERING SHEET WATERPROOFING

- a. Section 2.1.A.1. Added "e. Protecto Wrap. Jiffy Seal 140/60."

ITEM NO. 8. SECTION 074240 – MODULAR METAL WALL, ROOF AND SOFFIT PANELS

- a. Section 2.2.B.6. Revised panel sizes and added limitations.

ITEM NO. 9. SECTION 075423 – THERMOPLASTIC POLYOLEFIN (TPO) ROOFING

- a. Section 1.2.A. Deleted "substrate" from section list.
- b. Section 2.4.A.1 thru 3. Added this section for non-asphaltic laminated sheet to comply with FM standards.
- c. Section 2.4.B.1 thru 3. Moved this section A to B and added "Bases-of-Design Product".
- d. Section 2.6.B.1. Added this sentence regarding exposed fasteners.

ITEM NO. 10. SECTION 078100 – APPLIED FIREPROOFING

- a. Section 2.1.A.2.b. Add "supporting roofs only".

ITEM NO. 11. SECTION 078123 – INTUMSCENT FIREPROOFING

- a. Section 2.1.A.2.b. dd "supporting roofs only".

ITEM NO. 12. SECTION 084523 – FIBERGLASS-SANDWICH-PANEL ASSEMBLIES

- a. Section 2.1.H.1. Changed U-factor to 0.28.
- b. Section 2.6.D. Changed aluminum finish and warranty.

ITEM NO. 13. SECTION 087163.01 - DETENTION HARDWARE SETS

1. Hardware Sets S01, S01A, S01B S01C, S01D, S02, S02B and S02C.
 - a) Flush Pulls. Delete "BY SECURITY DOOR MFG.; USP; PJBC" and substitute "NW 602; US32D, NWSH".
2. Hardware Set 02A. Add the following hardware:
"1 EA LOOP PULL NW 601 US32D NWSH
1 EA FLUSH PULL NW 602 US32D NWSH"
3. Hardware Set S03A
 - a) Deadbolt Lock. Delete "7016" and substitute "7016 - ESC (1-WAY)".

ITEM NO. 14. SECTION 093000 - TILING

- a. Section 2.4.A.7. Added "Custom Building Products" as a manufacturer.
- b. Section 2.5.C.1.h. Added "Custom Building Products" as a manufacturer.

ITEM NO. 15. SECTION 096623 – RESINOUS MATRIX TERRAZZO FLOORING

- a. Section 3.5.B. Deleted this section and added "Not Used".

ITEM NO. 16. SECTION 105113 – METAL LOCKERS

- a. Section 2.2.A.6. Added “Lockers Manufacturing” as a manufacturer.

ITEM NO. 17. SECTION 111800 – SECURITY EQUIPMENT

- a. Section 1.2.A.1. Eliminated transaction window.
- b. Section 2.1. Eliminated transaction window, added “Not Used”.
- c. Section 2.1.A and B. Eliminated transaction window, added “Not Used”.

ITEM NO. 18. SECTION 115313 – LABORATORY FUME HOODS

- a. Section 1.2.A.1. Added room name “Evidence Processing C1047” for location.

ITEM NO. 19. SECTION 123553.13 – METAL LABORATORY CASEWORK

- a. Section 2.1.A.3. Added “(model numbers referenced on drawings)”.
- b. Section 2.1.A.8. Added “Air Master Systems Corp” as a manufacturer.

PROJECT MANUAL – VOLUME 3

ITEM NO. 20. SECTION 221313 FACILITY SANITAY SEWERS

- a. Replace specification section in its entirety with attached specifications. Modified to eliminate backwater valves from specification.

ITEM NO. 21. SECTION 237433 DEDICATED OUTDOOR-AIR UNITS

- a. Section 2.4.A. Revised the requirements for the supply fan.
- b. Section 2.10.I. Removed the requirement for integral lights.
- c. Section 2.11.D.8. Revised damper blade material to galvanized steel.

PROJECT MANUAL – VOLUME 4

ITEM NO. 22. SECTION 262313 GENERATOR PARALLELING LOW-VOLTAGE SWITCHGEAR

- a. Subparagraph 2.5.N.1: Delete “800” and substitute “4000”.
- b. Subparagraph 2.5.O.1: Delete “800” and substitute “4000”.

ITEM NO. 23. SECTION 263214 STATIONARY LOAD BANK

- a. Subparagraph 2.2.P: Add AVTRON as an approved equal.

ITEM NO. 24. SECTION 263353 STATIC UNINTERRUPTIBLE POWER SUPPLY

- a. Revise Subparagraph 1.2.A.3 as follows: “Modular N+1 UPS#2 (40KVA/36KW) capable of being upgradeable to 50KVA by addition of UPS modules within the same cabinet.”

ITEM NO. 25. SECTION 264313 SURGE PROTECTION FOR LOW-VOLTAGE ELECTRICAL POWER CIRCUITS

- a. Subparagraph 2.2.G.1: Delete “TG3-150-480-3Y-PNB-M3-F-2” and substitute “TG3-150-480-3Y-MNB-M3-F-2.”

ITEM NO. 26. SECTION 271300 COMMUNICATIONS BACKBONE CABLING

- a. Add Subparagraph 1.2.7 as follows: “7. Single mode fiber optic cabling.”

- b. Add Subparagraph 2.5.D as follows: "Description: Single mode, 12-strand, plenum rated, OS2, tight-buffered, non-armored."
- c. Add Subparagraph 2.5.D.1 as follows: "Use between Main Distribution Frame (MDF) and each Intermediate Distribution Frame (IDF)."

ITEM NO. 27. SECTION 284621.11 ADDRESSABLE FIRE-ALARM SYSTEMS

- a. Change Subparagraph 2.4.B.3 to 2.4.B.4
- b. Add Subparagraph 2.4.B.3 as follows: "3. Simplexgrinnell LP."

ITEM NO. 28. SECTION 312000 Earth Moving

- a. Section 2.1.I REVISE to read "Drainage Course: INDOT No. 53"
- b. Section 2.1.F. ADD "Surface Course: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand; ASTM D 294/D 2940M 0; with at least 95 percent passing a 1-inch (25-mm) sieve and not more than 9 percent passing a No. 200 sieve. "

ITEM NO. 29. SECTION 333245 – HORIZONTAL SHAFT COMMUNUTERS

- a. Replace specification section in its entirety with attached specification. Modified to include spare parts.

DRAWINGS – VOLUME I**ITEM NO. 30. DRAWING SD-103 REMOVALS PLAN – AREAS E, F, AND G**

- a. Added trees to north end of site.

ITEM NO. 31. DRAWING SD-401 – OVERALL SITE UTILITY PLAN

- a. Remove sheet SD-401 and replace with SD-401 dated 9/26/19. Changes are individually clouded.

ITEM NO. 32. DRAWING SD-401-A -- SITE UTILITY PLAN – AREA A

- a. Remove sheet SD-401-A and replace with SD-401-A dated 9/26/19. Changes are individually clouded.

ITEM NO. 33. DRAWING SD-401-B -- SITE UTILITY PLAN – AREA B

- a. Remove sheet SD-401-B and replace with SD-401-B dated 9/26/19. Changes are individually clouded.

ITEM NO. 34. DRAWING SD-401-C -- SITE UTILITY PLAN – AREA C

- a. Remove sheet SD-401-C and replace with SD-401-C dated 9/26/19. Changes are individually clouded.

ITEM NO. 35. DRAWING SD-401-D -- SITE UTILITY PLAN – AREA D

- a. Remove sheet SD-401-D and replace with SD-401-D dated 9/26/19. Changes are individually clouded.

ITEM NO. 36. DRAWING SD-402 -- ONSITE SANITARY SEWER PROFILES

- a. Remove sheet SD-402 and replace with SD-402 dated 9/26/19. Changes are individually clouded.

ITEM NO. 37. DRAWING SD-600 – TYPICAL SECTIONS

- a. Remove sheet SD-600 and replace with SD-600 dated 9/26/19. Changes are individually clouded.

ITEM NO. 38. DRAWING SD-601 – PLAN AND PROFILE

- a. Remove sheet SD-601 and replace with SD-601 dated 9/26/19. Changes are individually clouded.

ITEM NO. 39. DRAWING SD-602 – PLAN AND PROFILE

- a. Remove sheet SD-602 and replace with SD-602 dated 9/26/19. Changes are individually clouded.

ITEM NO. 40. DRAWING SD-603 – PLAN AND PROFILE

- a. Remove sheet SD-603 and replace with SD-603 dated 9/26/19. Changes are individually clouded.

ITEM NO. 41. DRAWING SD-701 – OFF-SITE SANITARY SEWER PROFILES

- a. Remove sheet SD-701 and replace with SD-701 dated 9/26/19. Changes are individually clouded.

ITEM NO. 42. DRAWING SD-804 – DETAIL 7 GRASS PAVING

- a. Add notes to detail as follows:
 - 1. Basis of Design Product: GrassPave2. Available through: Invisible Structures, Inc., 1600 Jackson St. Suite 310 ; Golden, CO 80401; Toll Free Tel: 800-233-1510; Tel: 303-233-8383; Email: request info (sales@invisiblestructures.com); Web: www.invisiblestructures.com. or approved equal.
 - 2. Approved equal: NDS EZ Roll Grass Paver

ITEM NO. 43. DRAWING S-001 GENERAL NOTES AND ABBREVIATIONS

- a. Remove sheet S-001 and replace with S-001 dated 9/26/19. Changes are individually clouded.

ITEM NO. 44. DRAWING S-101 FOUNDATION PLAN - OVERALL

- a. Remove sheet S-101 and replace with S-101 dated 9/26/19. Changes are individually clouded.

ITEM NO. 45. DRAWING S-101-A FOUNDATION PLAN – AREA A

- a. Remove sheet S-101-A and replace with S-101-A dated 9/26/19. Changes are individually clouded.

ITEM NO. 46. DRAWING S-101-B FOUNDATION PLAN – AREA B

- a. Remove sheet S-101-B and replace with S-101-B dated 9/26/19. Changes are individually clouded.

ITEM NO. 47. DRAWING S-101-C FOUNDATION PLAN – AREA C

- a. Remove sheet S-101-C and replace with S-101-C dated 9/26/19. Changes are individually clouded.

ITEM NO. 48. DRAWING S-101-D FOUNDATION PLAN – AREA D

- a. Remove sheet S-101-D and replace with S-101-D dated 9/26/19. Changes are individually clouded.

ITEM NO. 49. DRAWING S-101-E FOUNDATION PLAN – AREA E

- a. Remove sheet S-101-E and replace with S-101-E dated 9/26/19. Changes are individually clouded.

ITEM NO. 50. DRAWING S-102 MEZZANINE FLOOR AND ROOF FRAMING PLNS – AREA BC

- a. Remove sheet S-102 and replace with S-102 dated 9/26/19. Changes are individually clouded.

ITEM NO. 51. DRAWING S-103-A ROOF FRAMING PLAN – AREA A&B

- a. Remove sheet S-103-A and replace with S-103-A dated 9/26/19. Changes are individually clouded.

ITEM NO. 52. DRAWING S-103-B ROOF FRAMING PLAN AREA B

- a. Remove sheet S-103-B and replace with S-103-B dated 9/26/19. Changes are individually clouded.

ITEM NO. 53. DRAWING S-103-C ROOF FRAMING PLAN AREA C

- a. Remove sheet S-103-C and replace with S-103-C dated 9/26/19. Changes are individually clouded.

ITEM NO. 54. DRAWING S-103-D ROOF FRAMING PLAN AREA D

- a. Remove sheet S-103-D and replace with S-103-D dated 9/26/19. Changes are individually clouded.

ITEM NO. 55. DRAWING S-103-E ROOF FRAMING PLAN AREA E

- a. Remove sheet S-103-E and replace with S-103-E dated 9/26/19. Changes are individually clouded.

ITEM NO. 56. DRAWING S-201 FRAMING ELEVATIONS - 1

- a. Remove sheet S-201 and replace with S-201 dated 9/26/19. Changes are individually clouded.

ITEM NO. 57. DRAWING S-202 FRAMING ELEVATIONS -2

- a. Remove sheet S-202 and replace with S-202 dated 9/26/19. Changes are individually clouded.

ITEM NO. 58. DRAWING S-530 TYPICAL FOUNDATION DETAILS AND SECTIONS -1

- a. Remove sheet S-530 and replace with S-530 dated 9/26/19. Changes are individually clouded.

ITEM NO. 59. DRAWING S-531 TYPICAL FOUNDATION DETAILS AND SECTIONS-2

- a. Remove sheet S-531 and replace with S-531 dated 9/26/19. Changes are individually clouded.

ITEM NO. 60. DRAWING S-532 TYPICAL FOUNDATION DETIALS AND SECTIONS-3

- a. Remove sheet S-532 and replace with S-532 dated 9/26/19. Changes are individually clouded.

ITEM NO. 61. DRAWING S-540 TYPICAL MASONRY DETAILS AND SECTIONS -1

- a. Remove sheet S-540 and replace with S-540 dated 9/26/19. Changes are individually clouded.

ITEM NO. 62. DRAWING S-541 TYPICAL MASONRY DETAILS AND SECTIONS -2

- a. Remove sheet S-541 and replace with S-541 dated 9/26/19. Changes are individually clouded.

ITEM NO. 63. DRAWING S-551 TYPICAL FRAMING DETIALS AND SECTIONS -2

- a. Remove sheet S-551 and replace with S-551 dated 9/26/19. Changes are individually clouded.

ITEM NO. 64. DRAWING S-552 TYPICAL FRAMING DETAILS AND SECTIONS -3

- a. Remove sheet S-552 and replace with S-552 dated 9/26/19. Changes are individually clouded.

ITEM NO. 65. DRAWING S-553 FRAMING DETAILS AND SECTIONS -1

- a. Remove sheet S-553 and replace with S-553 dated 9/26/19. Changes are individually clouded.

ITEM NO. 66. DRAWING S-554 FRAMING DETAILS AND SECTIONS-2

- a. Remove sheet S-554 and replace with S-554 dated 9/26/19. Changes are individually clouded.

ITEM NO. 67. DRAWING S-601 COLUMN AND FOOTING SCHEDULE

- a. Remove sheet S-601 and replace with S-601 dated 9/26/19. Changes are individually clouded.

ITEM NO. 68. DRAWING S-701 LOADING DIAGRAMS - 1

- a. Remove sheet S-701 and replace with S-701 dated 9/26/19. Changes are individually clouded.

ITEM NO. 69. DRAWING S-702 LOADING DIAGRAMS -2

- a. Remove sheet S-702 and replace with S-702 dated 9/26/19. Changes are individually clouded.

ITEM NO. 70. DRAWING S-703 – LOADING DIAGRAMS - 3

- a. Remove sheet S-703 and replace with S-703 dated 9/26/19. Changes are individually clouded.

DRAWINGS – VOLUME 2

ITEM NO. 71. DRAWING A-101-B – FIRST FLOOR PLAN – AREA B

- a. Added borrowed lite tags at Nurse B1124 for B1124A and B1124B.
- b. Added tag to Cell B1046 access door B1046

ITEM NO. 72. DRAWING A-121 – ROOF PLAN

- a. Modified panel module layout in roof above lobby entry

ITEM NO. 73. DRAWING A-201 – EXTERIOR ELEVATIONS AND ENLARGED ELEVATIONS

- a. East Elevations – Entry Vestibule - Modified panel module layout on metal roof/wall around lobby entry vestibule
- a. South Elevation – Entry Vestibule - Modified panel module layout on metal roof/wall around lobby entry vestibule
- b. West Elevation – Lobby Clerestory - Modified panel module layout on metal roof/wall around lobby entry vestibule
- c. North Elevation – Enlarged Elevation - Modified panel module layout on metal roof/wall around lobby entry vestibule

ITEM NO. 74. DRAWING A-323 – WALL SECTIONS

- a. Wall Section 1
 1. Added detail items for channel, joint sealant and gypsum covering of bottom of deck
 2. Added keynotes for channel, gypsum and fire resistant joint sealant
 3. Added note: “Trim roof fasteners prior to installation of 5/8” gypsum board.”
- b. Wall Section 2
 1. Added detail items for channel, joint sealant and gypsum covering of bottom of deck
 2. Added keynotes for channel, gypsum and fire resistant joint sealant
 3. Added note: “Trim roof fasteners prior to installation of 5/8” gypsum board.”
- c. Wall Section 3
 1. Added detail items for channel, joint sealant and gypsum covering of bottom of deck
 2. Added keynotes for channel and gypsum
 3. Added note: “Trim roof fasteners prior to installation of 5/8” gypsum board.”

ITEM NO. 75. DRAWING A-328 – WALL SECTIONS

- a. Wall Section 5 – Added 121’ – 4” elevation mark, with a note to Field Verify, to top of Fixed Woven Rod Barrier.

ITEM NO. 76. DRAWING A-331 – WALL SECTIONS

- a. Wall Section 1.
 1. Dayroom Frame.
 - a) Shorten frame to 12’-0” A.F.F.

- b) Remove original wall type and add CMU to 1" up to bottom of roof deck.
- 2. Pod Control Frame.
 - a) Shorten frame to 12'-0" A.F.F.
 - b) Remove original wall type and change to CMU up to 16' – 0" A.F.F.
 - c) Added note for "Security Mesh" at gypsum wall above Pod Control.

ITEM NO. 77. DRAWING A-333 – WALL SECTIONS

- a. Wall Section 3 – EXTERIOR – WALL SECTION – NORTH WALL OF MASTER CONTROL
 - 1. Added detail items for channel, joint sealant and gypsum covering of bottom of deck
 - 2. Added keynotes for channel and gypsum
 - 3. Added note: "Trim roof fasteners prior to installation of 5/8" gypsum board."

ITEM NO. 78. DRAWING A-334 – WALL SECTIONS

- a. Added new Wall Section 4 – Non-Fire Rated Wall Around Pod Control

ITEM NO. 79. DRAWING A-335 – WALL SECTIONS

- a. Added new Wall Section 6 – Fire Rated Wall Around Pod Control

ITEM NO. 80. DRAWING A-401 – ENLARGED STAIR PLANS, SECTIONS & DETAILS

- a. Detail 5 - Modified frames around control room.

ITEM NO. 81. DRAWING A-452 – ENLARGED FLOOR PLAN AND ELEVATIONS

- a. Details 1 & 2 – Modified frames around Control Room and Dayrooms.

ITEM NO. 82. DRAWING A-455 – CASEWORK PLANS, ELEVATIONS, AND DETAILS

- a. Details 1 & 2 – Added note "*** METAL LABORATORY CASEWORK".

ITEM NO. 83. DRAWING A-601 – DOOR AND FRAME SCHEDULE – AREAS A, B & C

- a. Opening B1025.
 - 1. Frame Glazing. Delete "GCP-2/STL" and substitute "GCP-2".
- b. Opening C1065F.
 - 1. Door Thickness. Delete 5/8" and substitute 3/4".

ITEM NO. 84. DRAWING A-602 – DOOR AND FRAME SCHEDULE – AREAS D & E

- a. Opening D1005D.
 - 1. Door Thickness. Delete 1/2" and substitute 3/4".
- b. Opening E1009D.
 - 1. Door Thickness. Delete 1/2" and substitute 3/4".
- c. Openings D1005A, D1006A, D1020A, D1120A, E1008A, E1009A, E1020A & E1120A
 - 1. Frame Type. Delete "F-17" and substitute "F-17A".
 - 2. Jamb Detail. Delete "J4-A, B/A-606, J1/A-606" and substitute "J4-A, B/A-606, J1/A-607".
- d. Openings D1001B & E1001B.
 - 1. Jamb Detail. Delete "J4-A, B/A-606, J1/A-606" and substitute "J4-A, B/A-606, J1/A-607".
- e. Openings D1001A, D1002A, D1002B, E1001A, E1002A & E1002B
 - 1. Frame Type. Delete "F-17B" and substitute "F-17C".
 - 2. Jamb Detail. Delete "J4-A, B/A-606, J1/A-606" and substitute "J4-A, B/A-606, J1/A-607"
- f. Openings D1030A, D1040A, D1050A, D1060A, D1110A, E1030A, E1070A, E1080A, E1090A, E1110A

1. Frame Type. Delete "F-17A" and substitute "F-17D".
2. Jamb Detail. Delete "J4-A, B/A-606, J1/A-606" and substitute "J4-A, B/A-606, J1/A-607"
- g. Openings D1080A, D1090A, E1040A & E1050A
 1. Frame Type. Delete "F-17A" and substitute "F-17E".
 2. Jamb Detail. Delete "J4-A, B/A-606, J1/A-606" and substitute "J4-A, B/A-606, J1/A-607"
- h. Openings D1070A & E1060A.
 1. Frame Type. Delete "F-17A" and substitute "F-17F".
 2. Jamb Detail. Delete "J4-A, B/A-606, J1/A-606" and substitute "J4-A, B/A-606, J1/A-607"

ITEM NO. 85. DRAWING A-603 – FRAME SCHEDULE

- a. Openings D1000A, D1000B, D1000C, D1000D, D1000E, D1000F, D1000G, D1000H, D1000I & D1000J
E1000A, E1000B, E1000C, E1000D, E1000E, E1000F, E1000G, E1000H, E1000I & E1000J
 1. Head Detail. Delete "H2/A-611" and substitute "H1/A-607".
 2. Jamb Detail. Delete "J10/A-606, J2/A-611" and substitute "J1/A-607".
 3. Sill Detail. Delete "S1/A-606" and substitute "S1/A-607".
- b. Added frames B1112E, B1124A, and B1124B.

ITEM NO. 86. DRAWING A-604 – DOOR & WINDOW TYPES

- a. Frame Elevation F-11. Modify width of two lites.
- b. Frame Elevation F-15. Delete this frame in its entirety and substitute new Frame F-15 included herein.
- c. Frame Elevation F-17. Delete this frame in its entirety and substitute new Frame F-17 included herein for Frame Types F-17A through F-17F.
- d. Frame Elevation F-17A. Delete this frame in its entirety. Refer to new Frame F-17 included herein for Frame Type F-17A.
- e. Frame Elevation F-17B. Delete this frame in its entirety. Refer to new Frame F-17 included herein for Frame Type F-17B.
- f. Frame Elevation F-18. Delete 4" high horizontal mullion at sliding door housing and substitute 16" high mullion.
- g. Frame Elevation F-19A. Add ¾" stop to curtainwall jambs.
- h. Frame Elevation F-19B. Corrected vertical dimensions.
- i. Food Pass Section 6. Delete this detail in its entirety and substitute new Detail 6 included herein.

ITEM NO. 87. DRAWING A-605 – DOOR & WINDOW TYPES

- a. Borrowed Lite Elevation BL-3A & BL-3B. Removed head, jamb and sill tags not applicable to this frame.
- b. Borrowed Lite Elevation BL-4. Added horizontal lite dimensions and added reference to specification section for speakport and package transfer unit.
- c. Borrowed Lite Elevation BL-5A & BL-5B. Added horizontal lite dimensions.
- d. Borrowed Lite Elevation BL-6. Added horizontal lite dimensions and added reference to specification section for speakport and deal tray.
- e. Borrowed Lite Elevation BL-7. Delete this frame in its entirety and substitute new Frame BL-7 included herein.
- f. Borrowed Lite Elevation BL-8. Delete this frame in its entirety and substitute new Frame BL-8 included herein.
- g. Borrowed Lite Elevation BL-9. Added horizontal lite dimensions.
- h. Borrowed Lite Elevation BL-10. Added horizontal lite dimensions.
- i. Modified BL-2 to no longer say "BL-2A."
- j. Added BL-3C to elevation for BL-3A and BL-3B.

ITEM NO. 88. DRAWING A-607 – DOOR AND FRAME DETAILS

- a. H8 – Head Detail
 1. Added detail items for channel, joint sealant and gypsum covering of bottom of deck

2. Added keynotes for channel and gypsum
3. Added note: "Trim roof fasteners prior to installation of 5/8" gypsum board."

ITEM NO. 89. DRAWING A-608 – DOOR AND FRAME DETAILS

- a. Head Detail H3-B. Delete this detail in its entirety and substitute new Head Detail H3-B included herein.

ITEM NO. 90. DRAWING A-609 – DOOR AND FRAME DETAILS

- a. H2 – Head Detail
 1. Added detail items for channel, joint sealant and gypsum covering of bottom of deck
 2. Added keynotes for channel, gypsum and fire resistant joint sealant

ITEM NO. 91. DRAWING A-620 – ROOM FINISH SCHEDULE

- a. GENERAL NOTES – Added Note 11. "OPEN GRATE AT MEZZANINE AND STAIR TREADS LEADING UP TO MEZZANINE TO BE GALVANIZED STEEL. HANDRAILS, STRINGERS, FRAMING, ETC. IS TO BE PAINTED."
- b. REMARKS – Added C15, "OPEN GRATE WALKWAY AND STAIR TREADS UP TO WALKWAY TO BE GALVANIZED STEEL."
- c. FINISH ABBREVIATIONS
 1. FLOORS:
 - a) Added - OG – OPEN GRATE
 - b) Added - RS – RESINOUS FLOORING SYSTEM #1
- d. Room Numbers: D2020, D2030, D2040, D2050, D2060, D2070, D2080, D2090, D2110, D2120, E2020, E2030, E2040, E2050, E2060, E2070, E2080, E2090, E2110, E2120
 1. Floor Material changed from "- - -"to "OG"
 2. Remarks changed to C15.
- e. Added RS = Resinous Flooring System #1 to Finish Abbreviations:
 1. Replace all floor finishes marked EP with RS.

ITEM NO. 92. DRAWING A-803 – FIRST FLOOR ABOVE CEILING PLAN – OVERALL

- a. Added gypsum board between beams at entryway vestibule and lobby.

DRAWINGS – VOLUME 3**ITEM NO. 93. DRAWING P-100-B – UNDERFLOOR PLUMBING PLAN – AREA B**

- a. Inmate Toilet (B1131). Revise plumbing fixture callout from CU-2 to CU-3.

ITEM NO. 94. DRAWING P-101-B – FIRST FLOOR PLUMBING PLAN – AREA B

- a. Inmate Toilet (B1131). Revise plumbing fixture callout from CU-2 to CU-3.

ITEM NO. 95. DRAWING P-305 – SAN & V RISER DIAGRAM – AREA B

- a. Detail 1/P-305. Inmate Toilet (B1131). Revise plumbing fixture callout from CU-2 to CU-3.

ITEM NO. 96. DRAWING P-401 – ENLARGED PLUMBING PLAN – AREA B

- a. Detail 7/P-401. Inmate Toilet (B1131). Revise plumbing fixture callout from CU-2 to CU-3.

ITEM NO. 97. DRAWING P-404 – ENLARGED PLUMBING PLAN – AREA B

- a. Detail 7/P-404. Inmate Toilet (B1131). Revise plumbing fixture callout from CU-2 to CU-3.

ITEM NO. 98. DRAWING P-602 – PLUMBING EQUIPMENT SCHEDULE

- a. PLUMBING EQUIPMENT SCHEDULE, DWBP-1. Added verbiage requiring 50 PSI pressure increase.
- b. PLUMBING EQUIPMENT SCHEDULE, WS-1. Revised verbiage from 'Brine Day Tank' to 'Brine Tank'.

ITEM NO. 99. DRAWING M-500 – MECHANICAL HVAC DETAILS

- a. Detail 2/M-500. Remove note '16 GAUGE WELDED STEEL DUCT'.

DRAWINGS – VOLUME 4

ITEM NO. 100. DRAWING E-001 – GENERAL NOTES, SYMBOLS & ABBREVIATIONS

- a. Remove sheet E-001 and replace with E-001 dated 09/26/19. Changes are individually clouded.

ITEM NO. 101. DRAWINGS E-101 – ELECTRICAL SITE PLAN (NORTH)

- a. Remove sheet E-101 and replace with E-101 dated 09/26/19. Changes are individually clouded.

ITEM NO. 102. DRAWING E-102 – ELECTRICAL SITE PLAN (SOUTH)

- a. Remove sheet E-102 and replace with E-102 dated 09/26/19. Changes are individually clouded.

ITEM NO. 103. DRAWING E-201-A – FIRST FLOOR AND MEZZANINE POWER PLANS – AREA A

- a. Remove sheet E-201-A and replace with E-201-A dated 09/26/19. Changes are individually clouded.

ITEM NO. 104. DRAWING E-201-B – FIRST FLOOR POWER PLAN – AREA B

- a. Remove sheet E-201-B and replace with E-201-B dated 09/26/19. Changes are individually clouded.

ITEM NO. 105. DRAWING E-201-C – FIRST FLOOR POWER PLAN – AREA C

- a. Remove sheet E-201-C and replace with E-201-C dated 09/26/19. Changes are individually clouded.

ITEM NO. 106. DRAWING E-201-D – FIRST FLOOR POWER PLAN – AREA D

- a. Remove sheet E-201-D and replace with E-201-D dated 09/26/19. Changes are individually clouded.

ITEM NO. 107. DRAWING E-201-E – FIRST FLOOR POWER PLAN – AREA E

- a. Remove sheet E-201-E and replace with E-201-E dated 09/26/19. Changes are individually clouded.

ITEM NO. 108. DRAWING E-201-K – ENLARGED KITCHEN PLAN - ELECTRICAL

- a. Remove sheet E-201-K and replace with E-201-K dated 09/26/19. Changes are individually clouded.

ITEM NO. 109. DRAWING E-202-BC – PENTHOUSE PLAN - ELECTRICAL

- a. Remove sheet E-202-BC and replace with E-202-BC dated 09/26/19. Changes are individually clouded.

ITEM NO. 110. DRAWING E-203 – ROOF PLAN - ELECTRICAL

- a. Remove sheet E-203 and replace with E-203 dated 09/26/19. Changes are individually clouded.

ITEM NO. 111. DRAWING E-301-A – FIRST FLOOR AND MEZZANINE LIGHTING PLANS – AREA A

- a. Remove sheet E-301-A and replace with E-301-A dated 09/26/19. Changes are individually clouded.

ITEM NO. 112. DRAWING E-301-B – FIRST FLOOR LIGHTING PLAN – AREA B

- a. Remove sheet E-301-B and replace with E-301-B dated 09/26/19. Changes are individually clouded.

ITEM NO. 113. DRAWING E-301-C – FIRST FLOOR LIGHTING PLAN – AREA C

- a. Remove sheet E-301-C and replace with E-301-C dated 09/26/19. Changes are individually clouded.

ITEM NO. 114. DRAWING E-301-D – FIRST FLOOR AND LOWER LEVEL LIGHTING PLAN – AREA D

- a. Remove sheet E-301-D and replace with E-301-D dated 09/26/19. Changes are individually clouded.

ITEM NO. 115. DRAWING E-301-E – FIRST FLOOR AND LOWER LEVEL LIGHTING PLAN – AREA E

- a. Remove sheet E-301-E and replace with E-301-E dated 09/26/19. Changes are individually clouded.

ITEM NO. 116. DRAWING E-401-B – FIRST FLOOR SYSTEMS PLAN – AREA B

- a. Remove sheet E-401-B and replace with E-401-B dated 09/26/19. Changes are individually clouded.

ITEM NO. 117. DRAWING E-401-D – FIRST FLOOR AND LOWER LEVEL SYSTEMS PLAN – AREA D

- a. Remove sheet E-401-D and replace with E-401-D dated 09/26/19. Changes are individually clouded.

ITEM NO. 118. DRAWING E-401-E – FIRST FLOOR AND LOWER LEVEL SYSTEMS PLAN – AREA E

- a. Remove sheet E-401-E and replace with E-401-E dated 09/26/19. Changes are individually clouded.

ITEM NO. 119. DRAWING E-601 – ONE-LINE DIAGRAM

- a. Remove sheet E-601 and replace with E-601 dated 09/26/19. Changes are individually clouded.

ITEM NO. 120. DRAWING E-602 – ONE-LINE DIAGRAM

- a. Remove sheet E-602 and replace with E-602 dated 09/26/19. Changes are individually clouded.

ITEM NO. 121. DRAWING E-603 – CONDUIT AND CABLE SCHEDULE

- a. Remove sheet E-603 and replace with E-603 dated 09/26/19. Changes are individually clouded.

ITEM NO. 122. DRAWING E-604 – MECHANICAL EQUIPMENT ELECTRICAL CONNECTIONS SCHEDULE

- a. Remove sheet E-604 and replace with E-604 dated 09/26/19. Changes are individually clouded.

ITEM NO. 123. DRAWING E-606 – LIGHT FIXTURE SCHEDULES

- a. Remove sheet E-606 and replace with E-606 dated 09/26/19. Changes are individually clouded.

ITEM NO. 124. DRAWING E-607 – CATV RISER DIAGRAM AND TRANSFORMER SCHEDULE

- a. Remove sheet E-607 and replace with E-607 dated 09/26/19. Changes are individually clouded.

ITEM NO. 125. DRAWING E-701 – PANELBOARD SCHEUDLES

- a. Remove sheet E-701 and replace with E-701 dated 09/26/19. Changes are individually clouded.

ITEM NO. 126. DRAWING E-702 – PANELBOARD SCHEDULES

- a. Remove sheet E-702 and replace with E-702 dated 09/26/19. Changes are individually clouded.

ITEM NO. 127. DRAWING E-703 – PANELBOARD SCHEDULES

- a. Remove sheet E-703 and replace with E-703 dated 09/26/19. Changes are individually clouded.

ITEM NO. 128. DRAWING E-704 – PANELBOARD SCHEDULES

- a. Remove sheet E-704 and replace with E-704 dated 09/26/19. Changes are individually clouded.

ITEM NO. 129. DRAWING E-707 – PANELBOARD SCHEDULES

- a. Remove sheet E-707 and replace with E-707 dated 09/26/19. Changes are individually clouded.

ITEM NO. 130. DRAWING E-801 – ELECTRICAL DETAILS

- a. Remove sheet E-801 and replace with E-801 dated 09/26/19. Changes are individually clouded.

ITEM NO. 131. DRAWING E-802 – ELECTRICAL DETAILS

- a. Remove sheet E-802 and replace with E-802 dated 09/26/19. Changes are individually clouded.

ITEM NO. 132. DRAWING E-803 – ELECTRICAL DETAILS

- a. Remove sheet E-803 and replace with E-803 dated 09/26/19. Changes are individually clouded.

ITEM NO. 133. DRAWING E-804 – ELECTRICAL DETAILS

- a. Remove sheet E-804 and replace with E-804 dated 09/26/19. Changes are individually clouded.

ITEM NO. 134. DRAWING E-807 – ELECTRICAL DETAILS

- a. Remove sheet E-807 and replace with E-807 dated 09/26/19. Changes are individually clouded.

QUESTIONS AND ANSWERS

1. See Attached Bid Questions Log

ATTACHMENTS:

1. Pre-Bid Meeting Minutes
2. Bid Questions Log

PROJECT MANUAL – VOLUME 1

1. 013310 - CADD INFORMATION REQUEST FORM

PROJECT MANUAL – VOLUME 2

1. 033000 FL - CAST-IN-PLACE CONCRETE
2. 033616 – Reactive Chemical Stain
3. 074240 - MODULAR METAL WALL PANELS
4. 075423 FL - THERMOPLASTIC POLYOLEFIN (TPO) ROOFING
5. 087163.01 - DETENTION HARDWARE SETS
6. 115313 FL - LABORATORY FUME HOODS
7. 123216 FL - MANUFACTURED PLASTIC-LAMINATE-FACED CASEWORK

PROJECT MANUAL – VOLUME 3

1. 221313 - FACILITY SANITARY SEWERS
2. 237433 - DEDICATED OUTDOOR-AIR UNITS

PROJECT MANUAL – VOLUME 4

1. 262313 - GENERATOR PARALLELING LOW-VOLTAGE SWITCHGEAR
2. 263214 - STATIONARY LOAD BANK
3. 263353 - STATIC UNINTERRUPTIBLE POWER SUPPLY
4. 264313 - SURGE PROTECTION FOR LOW-VOLTAGE ELECTRICAL POWER CIRCUITS
5. 271300 - COMMUNICATIONS BACKBONE CABLING
6. 284621.11 - ADDRESSABLE FIRE-ALARM SYSTEMS
7. 333245 - HORIZONTAL SHAFT COMMUNUTERS

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6. SD-401-D SITE UTILITY PLAN – AREA D
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34. S-552 TYPICAL FRAMING DETAILS AND SECTIONS – 3
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36. S-554 FRAMING DETAILS AND SECTIONS -5
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224213.13	COMMERCIAL WATER CLOSETS
224213.16	COMMERCIAL URINALS
224216.13	COMMERCIAL LAVATORIES
224216.16	COMMERCIAL SINKS
224223	COMMERCIAL SHOWERS
224500	EMERGENCY PLUMBING FIXTURES
224600	SECURITY PLUMBING FIXTURES
224716	PRESSURE WATER COOLERS

DIVISION 23 – HEATING, VENTILATING AND AIR CONDITIONING

230513	COMMON MOTOR REQUIREMENTS FOR HVAC EQUIPMENT
230516	EXPANSION FITTINGS AND LOOPS FOR HVAC PIPING
230517	SLEEVES AND SLEEVE SEALS FOR HVAC PIPING
230518	ESCUTCHEONS FOR HVAC PIPING
230519	METERS AND GAGES FOR HVAC PIPING
230523	GLOBE VALVES FOR HVAC PIPING
230523.12	BALL VALVES FOR HVAC PIPING
230523.13	BUTTERFLY VALVES FOR HVAC PIPING
230523.14	CHECK VALVES FOR HVAC PIPING
230523.15	GATE VALVES FOR HVAC PIPING
230523.16	PLUG VALVES FOR HVAC PIPING
230529	HANGERS AND SUPPORTS FOR HVAC PIPING AND EQUIPMENT
230548	VIBRATION CONTROLS FOR HVAC PIPING AND EQUIPMENT
230553	IDENTIFICATION FOR HVAC PIPING AND EQUIPMENT
230593	TESTING, ADJUSTING, AND BALANCING FOR HVAC
230713	DUCT INSULATION

230716	HVAC EQUIPMENT INSULATION
230719	HVAC PIPING INSULATION
230923	DIRECT DIGITAL CONTROL (DDC) SYSTEM FOR HVAC
230924	REFRIGERANT DETECTION AND ALARM
232113	HYDRONIC PIPING
232116	HYDRONIC PIPING SPECIALTIES
232123	HYDRONIC PUMPS
232300	REFRIGERANT PIPING
232513	WATER TREATMENT FOR CLOSED-LOOP HYDRONIC SYSTEMS
233113	METAL DUCTS
233300	AIR DUCT ACCESSORIES
233346	FLEXIBLE DUCTS
233423	HVAC POWER VENTILATORS
233433.13	COMMERCIAL AIR CURTAINS
233600	AIR TERMINAL UNITS
233713.13	AIR DIFFUSERS
233713.23	REGISTERS, AND GRILLES
233713.43	SECURITY REGISTERS, AND GRILLES
233723	HVAC GRAVITY VENTILATORS
235123	GAS VENTS
235216	CONDENSING BOILERS
235523.13	LOW-INTENSITY, GAS-FIRED, RADIANT HEATERS
236426.13	AIR-COOLED, ROTARY-SCREW WATER CHILLERS
237313.13	INDOOR, BASIC AIR-HANDLING UNITS
237416.11	PACKAGED, SMALL-CAPACITY, ROOFTOP AIR-CONDITIONING UNITS
237433	DEDICATED OUTDOOR-AIR UNITS
238123.13	COMPUTER-ROOM AIR-CONDITIONERS, CEILING-MOUNTED UNITS
238126	SPLIT-SYSTEM AIR CONDITIONERS
238219	FAN COIL UNITS
238239.16	PROPELLER UNIT HEATERS
238239.19	WALL AND CEILING UNIT HEATERS

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DIVISION 26 – ELECTRICAL

260519	LOW VOLTAGE ELECTRICAL POWER CONDUCTORS & CABLES
260526	GROUNDING & BONDING FOR ELECTRICAL SYSTEMS
260529	HANGARS AND SUPPORTS FOR ELECTRICAL SYSTEMS
260533	RACEWAY & BOXES FOR ELECTRICAL SYSTEMS
260544	SLEEVES AND SLEEVE SEALS FOR ELECTRICAL RACEWAYS AND CABLING
260548.16	SEISMIC CONTROLS FOR ELECTRICAL SYSTEMS
260553	IDENTIFICATION FOR ELECTRICAL SYSTEMS
260573.13	SHORT-CIRCUIT STUDIES
260573.16	COORDINATION STUDIES
260573.19	ARC-FLASH HAZARD ANALYSIS
260923	LIGHTING CONTROL DEVICES
262213	LOW-VOLTAGE DISTRIBUTION TRANSFORMERS

262313	PARALLELING LOW-VOLTAGE SWITCHGEAR
262413	SWITCHBOARDS
262416	PANELBOARDS
262500	ENCLOSED BUS ASSEMBLIES
262726	WIRING DEVICES
262813	FUSES
262816	ENCLOSED SWITCHES AND CIRCUIT BREAKERS
262913.03	MANUAL AND MAGNETIC MOTOR CONTROLLERS
262923	VARIABLE FREQUENCY MOTOR CONTROLLERS
263213	DIESEL ENGINE GENERATORS
263353	STATIC UNINTERRUPTIBLE POWER SUPPLY
263600	TRANSFER SWITCHES
264313	SURGE PROTECTION FOR LOW-VOLTAGE ELECTRICAL POWER CIRCUITS
265119	LED INTERIOR LIGHTING
265613	LIGHTING POLES AND STANDARDS
265619	LED EXTERIOR LIGHTING

DIVISION 27 - COMMUNICATIONS

270526	GROUNDING AND BONDING FOR COMMUNICATIONS SYSTEMS
270528	PATHWAYS FOR COMMUNICATIONS SYSTEMS
270529	HANGERS AND SUPPORTS FOR COMMUNICATIONS SYSTEMS
270536	CABLE TRAYS FOR COMMUNICATIONS SYSTEMS
270544	SLEEVES AND SLEEVE SEALS FOR COMMUNICATIONS PATHWAYS AND CABLING
270548.16	SEISMIC CONTROLS FOR COMMUNICATIONS SYSTEMS
270553	IDENTIFICATION FOR COMMUNICATIONS SYSTEMS
271100	COMMUNICATIONS EQUIPMENT ROOM FITTINGS
271116	COMMUNICATIONS RACKS, FRAMES, AND ENCLOSURES
271313	COMMUNICATIONS COPPER BACKBONE CABLING
271323	COMMUNICATIONS OPTICAL FIBER BACKBONE CABLING
271333	COMMUNICATIONS COAXIAL BACKBONE CABLING
271513	COMMUNICATIONS COPPER HORIZONTAL CABLING
271533	COMMUNICATIONS COAXIAL HORIZONTAL CABLING
274133	MASTER ANTENNA TELEVISION SYSTEM

DIVISION 28 – ELECTRONIC SAFETY AND SECURITY

280500	COMMON WORK RESULTS FOR ELECTRONIC SAFETY AND SECURITY
280510	CABINETS AND ENCLOSURES
281300	ACCESS CONTROL SYSTEM
282300	VIDEO COMMUNICATION SYSTEM
284619	SECURITY AUTOMATION SYSTEM
284620	VIDEO GRAPHIC USER INTERFACE
284621.11	ADDRESSABLE FIRE-ALARM SYSTEMS
285123	AUDIO COMMUNICATIONS SYSTEM

DIVISION 31 – EARTHWORK

311000	SITE CLEARING
312000	EARTH MOVING
312319	DEWATERING
315000	EXCAVATION SUPPORT AND PROTECTION
316400	STONE COLUMNS

DIVISION 32 – EXTERIOR IMPROVEMENTS

321216	ASPHALT PAVING
321313	CONCRETE PAVING
321373	CONCRETE PAVING JOINT SEALANTS
321400	UNIT PAVING
321713	PARKING BUMPERS
321723	PAVEMENT MARKINGS
321726	TACTILE WARNING SURFACING
323113.53	HIGH-SECURITY CHAIN LINK FENCES AND GATES
323119.53	DECORATIVE METAL SECURITY FENCES AND GATES
329113	SOIL PREPARATION
329200	TURF AND GRASSES
329300	PLANTS

DIVISION 33 – UTILITIES

334100	STORM UTILITY DRAINAGE PIPING
334600	SUBDRAINAGE

END OF SECTION 000002

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SECTION 011200 - MULTIPLE CONTRACT SUMMARY**PART 1 - GENERAL****1.01 RELATED DOCUMENTS**

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

1.02 SUMMARY

- A. Section includes a summary of each contract, including responsibilities for coordination and temporary facilities and controls.
- B. Specific requirements for Work of each contract are also indicated in individual Specification Sections and on Drawings.
- C. The narrative description to follow is provided to assist the bidder in determining the various trade contracts/bid packages involved in the project. The term 'Contractor' and 'Prime Contractor' are used interchangeably throughout this document and have the same meaning.

1.03 INCLUDED SECTIONS PROVIDED BY CONSTRUCTION MANAGER

- A. General Construction Building Permit – Excludes MEP
- B. Material Testing and Inspection Services
- C. Temporary Toilets
- D. Dumpsters
- E. Temporary Utility Usage Charges
- F. Perimeter Job Site Fencing
- G. Temporary Project Signage

1.04 EXCLUDED SECTION BY CONSTRUCTION MANAGER

- A. MEP Permits
- B. Onsite Project Offices for Prime Contractors, utility hookups, or use charges
- C. All material deliveries, handling, hoisting, and unloading
- D. Copies of plans and specifications
- E. Progress cleaning
- F. All work corresponding and concrete and masonry winter conditions/protection i.e. concrete blankets, masonry tented structures, admixtures, etc.

2.01 COMMONS SCOPES OF WORK FOR ALL TRADES

- A. This project is Sales Tax Exempt. Reference Supplemental General Conditions for details
- B. All additional work must be approved in writing by the Project Manager. Project superintendent is limited to approval of \$500 of additional work on an emergency basis only.

- C. No additional work will be considered for approval without written and signed Construction Daily Extra Work Authorization sheets, detailing the scope of work and the materials, labor and equipment used. Garmong's field superintendent must sign these forms on a daily basis; signed, completed sheets, including costs must be submitted to the Project Manager on a weekly basis.
- D. The Contractor shall employ a competent Foreman who shall be onsite fulltime during the progression of work. This Foreman shall have full authority to manage project labor, manage equipment deliveries, and maintain the CM's project schedule. The full time Foreman shall be the point of contact for the field operations and shall attend weekly progress meetings.
- E. All Contractor's shall comply with the Storm Water Pollution Prevention Plan (SWPPP). Soil Erosion Control will be installed by BP#1. Any Contractor that damages or removes silt fence or any type of erosion control measure, for any reason including to perform work, is responsible to replace or repair it the same business day that it was damaged. Failure to do so same day will result in the immediate completion of this work by others, as directed by the CM, and all associated costs will be back-charged to the removing Contractor.
- F. Keep all roads and traffic routes clean and free of mud and debris at all times. All Contractors are responsible for cleaning the streets of all mud and debris generated from their operations. Contractors violating this requirement are subject to fines.
- G. Construction Manager will obtain the overall building permit. Each trade is responsible to include and obtain the permits and coordinate inspections for their own individual scope of work. All work shall be completed in accordance with applicable local, state, and federal codes, rules and regulations. Contractors are required to notify CM prior to and after all inspections.
- H. Each trade is responsible for all layout and applicable engineering required to complete all work of their bid package to exact dimensions and locations including verification of preceding work performed by other trades prior to the Contractor's installation. Immediately report all discrepancies to CM.
- I. The construction schedule requires multiple crews to complete work. Contractors must expect overlap between their work and other trades that will complete work before and after. "Out of sequence" work shall be expected and considered when submitting bids. Contractors shall include multiple mobilizations to complete the scope of work, and coordinate delivery schedules with the project schedule and construction sequencing. Schedule must be maintained. If overtime is required to maintain schedule, Contractor shall include overtime in proposal. The project target schedule follows this section.
- J. Provide temporary power and additional lighting as necessary for proper installation during preparation and installation of work.
- K. Provide proof of identification of existing utilities (*public or private*) to CM prior to start of underground and sawcutting.
- L. Attendance at progress meetings is mandatory when a trade is mobilized to the site. Failure to attend, without prior notification, will result in a \$100 deduct Change Order.
- M. Each Contractor is responsible to receive, unload, store, handle, protect, and install all items respective to their responsibilities
- N. Each Contractor shall provide access panels for their scope of work.
- O. Protect all other trades work in place and properly staged materials from damage of any kind which could be caused while performing any preparation or installation of their own work. Any cleaning, repair or additional costs, will be the responsibility of the Contractor causing or responsible for the damage.

- P. Sawcutting and grinding shall be accomplished using either vacuum-assisted or with wet methods to conform to OSHA requirements.
- Q. Contractors are responsible for the removal or demolition and replacement/rerouting of existing items and systems required to perform their Scope of Work regardless of specific inclusion in the Contract Documents.
- R. Provide expansion compensation in all pipelines, conduit, ducts, etc., crossing building expansion joints at building column lines.
- S. Review finish schedule and locate all exposed concrete floor finishes. Contractors must protect these areas from stains and other damage while performing their work. Clean or repair as necessary.
- T. The CM is to be notified prior to any above ceiling work after ceiling tile installation. The Contractor performing work is responsible to remove and replace ceiling tile as required. All ceiling tile must be reinstalled at the end of the shift, unless approved by the CM. Contractor performing work will assume all responsibility for replacement of any damaged ceiling system.
- U. All equipment placed on finished floors must have protective material underneath to protect the floor.
- V. Repair to damaged roofing will be entirely at the risk of the responsible Contractor. If the damage cannot be definitively assigned, CM will unilaterally determine who the responsible parties are. All contractors are responsible for providing required supports for their equipment whether or not indicated on the drawings.
- W. Clean up, removal, & disposal from site to dumpster of all debris, including sweeping of the work areas, shall be performed on a DAILY basis. All packing and shipping crates and boxes will be removed offsite within 48 hours.
- X. A composite crew consisting of one person from each trade contractor present on site shall provide a person for the composite cleaning crew. The composite crew will perform Project cleanup under the direction of the Construction Manager on a weekly basis, with a day and time dictated by the Construction Manager.
- Y. Contractor shall include all necessary protection of their work until work is completed.
- Z. Items of work may be shown on drawings and/or listed in the specifications of the Contract Documents. If any item of work is shown on either the drawings or specifications but not the other, it is included in the contract and the better quality or greater quantity of work shall be provided in accordance with the architect/engineer's instructions. No change order or extra to the contract will be allowed for any inconsistency when any item of work either is shown on the drawings/specifications regardless of the location in the drawings/specifications.
- AA. Contractor must coordinate a meeting with the onsite superintendent to inspect all surfaces to receive materials, prior to commencement of work. Report in writing to the onsite superintendent, any condition that may potentially affect proper application. Do not commence until such defects have been corrected. **Commencement of work shall be construed, as acceptance** of the surfaces and therefore, the Contractor shall be fully responsible for satisfactory work as required herein. As such, after commencement of work Contractor cannot add changes orders to this contract.
- BB. Coordinate all work with other Contractors to ensure other scopes of work don't affect this scope of work.
- CC. It is recognized and understood by the Contractor at the time of contract award, that Contractor was selected for their expertise and knowledge of this specialized work and it was and is expected that the Contractor did and has included in their scope of work all

items required to carry out the A/E's intent for a complete and functional system. The contract price will not be increased for any miscellaneous or incidental items required for the work to meet the intent of the Architect's design, the contract documents, plans, specifications and code requirements.

- DD. The drawings are diagrammatic and may not be complete in every detail. They reflect the intent of the Architect/Engineer to provide for a complete working system in compliance with all applicable codes. Contractors shall include any other equipment or devices necessary to provide a complete, functioning system. Contractors shall include, as part of their work, the cost of re-routing, etc., due to the coordination procedure as part of their contract price.
- EE. Contractors shall submit their proposals based on the Work included under each Bid Package as listed herein. Include Work necessary for a complete project, as shown on the Drawings and called for in the Specifications.
- FF. Questions concerning the "Multiple Contract Summary" should be directed to the Construction Manager, who will be the interpreter and be responsible for this Schedule of Contract Responsibilities and Contract Breakdown, prior to submitting proposals and during construction.
- GG. All Contractors shall be responsible for field verification of materials and equipment installed in the Work of other Contractors.
- HH. Certain Specification Sections describe Work to be performed under several contract areas. (Example: 079200, Joint Sealants). Provide Work of this nature as required for each contract area whether or not enumerated in the Schedule of Contract Responsibilities. The Contractor for each Bid Package shall be responsible for proper installation of sealant around and within his work. The Contractor who defines the joint (last Contractor there usually) shall be responsible for sealing the joint, if the Architect requires sealant to be installed after finish work is in-place, then the finish Contractor shall seal the joint. All joints at dissimilar material intersections shall be caulked.
- II. All penetrations in rated partitions shall be sealed or firesafe in accordance with the Contract Documents by the Contractor making the penetration.
- JJ. The following bid packages are broken down by Specifications Section conforming to the CSI format. Each bid package also contains a statement of intent for a general description of the work included. The Contractor is responsible for work assigned and described as part of their contract category without regard for where it is indicated in the Contract Documents.
- KK. The Drawings and Specifications as furnished for each of the Contracts is for the convenience of the Contractor in preparing a proposal for this Project. However, each Contractor is responsible to review the complete set of Drawings and Specifications to assure that Work required to be installed to complete their phase of the Work is included in their proposal. This "Multiple Contract Summary" is a definition of the work as it is to be bid in separate contracts. Where a specific item of Work is not defined, but is normally inherent to a trade, or is included in the scope of the applicable technical section, it will be the responsibility of that Contractor to include the Work in his proposal.
- LL. This "Multiple Contract Summary" is to aid each Contractor by defining the Scope of Work to be included in their proposal. However, an omission from this "Multiple Contract Summary" does not relieve the Contractor from including in their proposal that Work which will be required to complete their Contract. Each Contractor should

read the "Multiple Contract Summary" completely to familiarize themselves with the Work of other Contractors that may have Work in adjacent areas and to coordinate the interfacing problems that may occur as the Work is assembled and constructed.

- MM. Additional description of the work may be included in the specification sections listed.
- NN. The Contractors shall keep all excavations free of standing water. Each Prime Contractor shall be responsible for pumping water or otherwise removing water from any excavation or low area created because of his work. Each Contractor is to take containment measures to prevent the run-off of surface water into excavations and the bonding of water on-site. Any damage or additional cost incurred as the result of standing water or its penetration of the soils shall be borne, by the Prime Contractor allowing/creating the situation where water accumulated.
- OO. The Prime Contractors are responsible for coordinating their subcontractors. The Construction Manager and the Prime Contractors shall coordinate and schedule the work of the Prime Contracts. The Project Schedule attached to the end of this Specification Section is part of the Contract Documents. Each Prime Contractor will be required to meet the durations and dates shown in the schedule.
- PP. All Contractors are required to warranty their work for twelve (12) months from the date of Substantial Completion.

Addendum No. 3 Revisions – The following items are to be added to this scope of work:

- QQ. Each Bid Package is responsible for the excavation, backfill and compaction of any underground work associated with their scope of work. This shall include the import and/or export of all materials including fills and spoils.

3.01 SPECIFIC SCOPES OF WORK FOR BID PACKAGES

BID CATEGORY BP. NO. 1 GENERAL TRADES SCOPE OF WORK

This Scope of Work is to include, but is not limited to, the following Specification Sections:

<u>Section</u>	<u>Description</u>
Division 00	Procurement and Contracting Requirements
Division 01	General Requirements
03 10 00	CONCRETE FORMING AND ACCESSORIES
03 20 00	CONCRETE REINFORCING
03 30 00	CAST-IN-PLACE CONCRETE
03 36 16	REACTIVE CHEMICAL STAIN – Added per Addendum No. 3
03 41 00	PRECAST STRUCTURAL CONCRETE
03 41 30	PRECAST PRESTRESSED HOLLOWCORE SLAB UNITS
04 21 13	Brick Masonry – Thin Brick – Added per Addendum No. 3
06 10 53	MISCELLANEOUS ROUGH CARPENTRY
06 16 00	SHEATHING
07 13 26	SELF-ADHERING SHEET WATERPROOFING
07 21 00	THERMAL INSULATION
07 24 19	WATER DRAINAGE EXTERIO INSULATION AND FINISH SYSTEM (EIFS)
07 26 00	VAPOR RETARDERS
07 81 00	APPLIED FIREPROOFING
07 81 23	INTUMESCENT FIREPROOFING
07 84 13	PENETRATION FIRESTOPPING
07 84 43	JOINT FIRESTOPPING
07 91 00	PREFORMED JOINT SEALS
07 92 00	JOINT SEALANTS
08 11 13	HOLLOW METAL DOORS AND FRAMES
08 11 13	FLUSH WOOD DOORS
08 31 13	ACCESS DOORS AND FRAMES
08 31 19	SECURITY ACCESS DOORS AND FRAMES
08 33 23	OVERHEAD COILING DOORS
08 34 63	DETENTION DOORS AND FRAMES
08 36 13	SECTIONAL DOORS
08 41 13	ALUMINUM-FRAMED ENTRANCES AND STOREFRONTS
08 44 13	GLAZED ALUMINUM CURTAIN WALLS
08 45 23	FIBERGLASS SANDWICH-PANEL ASSEMBLIES
08 56 63	DETENTION WINDOWS AND SKYLIGHTS
08 71 00	DOOR HARDWARE
08 71 63	DETENTION DOOR HARDWARE
08 71 63A	DETENTION DOOR HARDWARE SETS
08 80 00	GLAZING
08 88 53	SECURITY GLAZING
09 69 00	ACCESS FLOORING
09 84 10	FIXED SOUND ABSORBING PANELS —Delete per Addendum No. 2

10 11 00	VISUAL DISPLAY UNITS
10 14 16	PLAQUES
10 14 19	DIMENSIONAL LETTER SIGNAGE
10 14 23	PANEL SIGNAGE
10 14 26	POST AND PANEL - PYLON SIGNAGE
10 21 13	TOILET COMPARTMENTS
10 21 31	WELDING CURTAINS
10 26 00	WALL PROTECTION
10 28 00	TOILET, BATH AND LAUNDRY ACCESSORIES
10 28 13.63	DETENTION TOILET ACCESSORIES
10 44 13	FIRE PROTECTION CABINETS
10 44 16	FIRE EXTINGUISHERS
10 51 13	METAL LOCKERS
10 51 14	EVIDENCE LOCKERS
10 56 26	MOBILE STORAGE SHELVING
10 57 00	RAPID ENTRY LOCKBOX
10 73 16	ALUMINUM CANOPIES
10 75 00	FLAGPOLES
11 17 36	PACKAGE TRANSFER UNITS – Delete per Addendum No. 3
11 19 16	DETENTION GUN LOCKERS – Delete per Addendum No. 3
11 29 23	INMATE PROPERTY PACKAGING EQUIPMENT – Delete per Add. No. 3
12 21 13	HORIZONTAL LOUVER BLINDS
12 32 16	MANUFACTURED PLASTIC-LAMINATE -FACED CASEWORK
12 36 16	METAL COUNTERTOPS
12 36 61	SOLID SURFACING COUNTERTOPS
12 52 83	FIXED BEAM SEATING Deleted per Addendum No. 3
12 56 00	INSTITUTIONAL FURNITURE Delete per Addendum No. 2
12 93 00	SITE FURNISHINGS
31 10 00	SITE CLEARING
31 20 00	EARTH MOVING
31 23 19	DEWATERING
31 50 00	EXCAVATION SUPPORT AND PROTECTION
31 64 00	ENGINEERED AGGREGATE PIERS – Revised per Addendum No. 3
32 13 13	CONCRETE PAVING
32 13 73	CONCRETE PAVING JOINT SEALANTS
32 14 00	UNIT PAVING
32 17 13	PARKING BUMPERS-- Deleted per Addendum No. 3
32 17 23	PAVEMENT MARKINGS -Deleted per Addendum No. 3
32 17 26	TACTILE WARNING SURFACING
32 31 13.53	HIGH-SECURITY CHAIN LINK FENCES AND GATES
32 31 19.53	DECORATIVE METAL SECURITY FENCES AND GATES
32 91 13	SOIL PREPARATION
32 92 00	TURF AND GRASSES

32 93 00	PLANTS
33 05 13	
	PRECAST CONCRETE MANHOLES AND STRUCTURES
33 41 00	STORM UTILITY DRAINAGE PIPING
33 46 00	SUBDRAINAGE

This Bid Category Scope of Work describes and assigns Work to this Bid Category as designated by the Construction Manager. Each Contractor shall cooperate and coordinate with all other Bid Category Contractors for proper and expedient completion of the Work in this Project. This summary should in no way be construed as being all inclusive. It is issued as a guide to aid in the assignment of Work and is intended to clarify and/or further define the Scope of Work included in the Bid Documents. They shall not be construed as the entire Scope of Work for this Bid Category. All work described or indicated in the respective Specifications Sections or Divisions listed above shall be included, except as specifically excluded herein.

A. General items to be included in this scope of work

1. Provide all surveying and layout required to complete the work of this category. This shall include providing control layout points/lines for all other trades.
2. Include an allowance for CM Directed Work in the amount of 1,750 manhours. This allowance will be used at the direction of the Construction Manager for coordination, safety, cleanup and any other item deemed necessary by the Construction Manager. All unused portions of this allowance shall be returned to the Owner via a deductive change order.
3. Contractor shall provide and install all temporary roads, parking areas and laydown areas for the project. This will include the installation of stone roads and pathways throughout the duration of the project. All areas shall be installed and maintained such that they do not hold water, they do provide proper access for equipment and materials to the building and are removed upon the completion of the work. It is anticipated that all access roads will follow the paved areas and the grass paver areas currently shown on the construction documents. Additional access lanes are to be provided around the building as necessary for the construction of the project. This will include access for jail cells, cranes, trucks, etc. Maintenance of the roads shall include adding stone as necessary for road maintenance and the removal of accumulated mud and/or dirt.
4. Provide all snow removal for the project site. Contractor shall remove snow so that all access and parking areas are accessible.
5. This scope shall include all associated work for the entrance road from Honey Creek Drive to the project site as indicated in Areas "E" & "F" in the Site Development drawings
6. Provide a telescoping boom fork truck lift on site starting with the commencement of concrete foundations and continuing until project completion as directed by CM. The fork lift is intended for general site usage (deliveries, group clean-ups, miscellaneous material laydown organization). Individuals using the lift will be responsible for providing their own operator. The general laborer time is intended for miscellaneous activities as requested by CM (clean-up, maintaining fall protection, etc.). Labor hours will be tracked using a log in the CM trailer that will require sign-off of all hours spent from the General Trades Contractor and CM superintendent.
7. Provide the final clean for the entire project. This shall include all sweeping, vacuuming, dusting, waxing of floors, glass cleaning (inside and outside), cell cleaning, cleaning of

showers, toilets, furniture, inside and outside of cabinets, walls moldings, etc. for complete clean of the entire project.

B. Demolition

1. Contractor will provide all labor, materials and equipment necessary to demolish complete, all materials indicated to be demolished in the Contract Documents.
2. All demolished materials shall be removed to a dumpster provided by the Construction Manager.
3. Sawcut all existing pavements prior to removal. Repair any damages that may occur to existing pavements to remain.

C. Erosion Control

1. Furnish and Install all erosion control turbidity barriers, silt fence, hay bales, etc. as needed to protect adjacent property and all utilities. This Contractor will maintain erosion control daily for the entire project during the performance of this scope of work and until completion of the project and will decommission and clean as required at completion.
2. If drainage systems are infiltrated with sedimentation, Contractor shall clean all effected pipes and structures of dirt.
3. It is the responsibility of this Contractor to protect all trees and vegetation designated to remain.
4. This Contractor is responsible for dust control and traffic control (including traffic control signage required) for the duration of the project. All mud, dirt. Sand or other material tracked or spilled onto existing public and / or private road shall be removed and cleaned by this Contractor daily or as directed by Garmong. Also, water trucks, hoses and any other necessary means will be utilized to minimize and control dust onsite.
5. Maintain all erosion control measures for the duration of this project.
6. Install all stone. This includes installation and maintenance of stone for construction entrances and drives for the life span of the project.
7. Provide all required temporary seeding that may be necessary due to inactivity.
8. This scope shall include the removal of all erosion control measures installed on the project and remediation of any disturbed grades due to this work. This shall include grading and seeding of the ditch line where the silt fence is removed.
9. Inspect and repair all erosion control measures weekly and following all rain events. Provide written report of these inspections to the authorities having jurisdiction.

D. Earthwork

1. This Contractor is responsible for locating all existing utilities prior to work operations. Furnish, install and coordinate all private utility locator's services as required prior to commencing this work. This Contractor agrees that any existing utilities that may be damaged during work shall be repaired at this Contractor's expense.
2. All dewatering as required for the performance of this bid package.
3. Wherever work encroaches on existing sod or paved areas, restore those areas to original condition after completion of the work. This includes all sod, new asphalt, new concrete, grading or other work required to complete the renovated area.
4. Include all tree removal/demolition required for the installation of work of this bid package. Regrade all areas where demolition occurs and utilities are installed, ready for final landscaping, and install temporary seeding.
5. All necessary traffic control and barricades for the proper and safe execution of the Work shall be furnished and maintained by this Contractor.

6. The Contractor shall dispose of any unsuitable materials off site.
 7. This Contractor understands that there will be "out of sequence" work with respect to the work and has included such in this agreement.
 8. The services of the soil engineer to perform soil testing, inspection services, and concrete testing will be provided by others. Contractor shall be responsible for coordinating with these services. The soil testing, concrete testing, and inspection does not in any way relieve the Contractor of its overall responsibility.
 9. Spoils generated by the stone column work will be removed and/or used.
 10. Contractor is responsible for all quantities of soil on site. This includes any import or export as needed for proper completion of this work.
 11. Site clearing including all grubbing and topsoil removal of the site.
 12. All excavation, cuts, fills and grading as required by the contract documents.
 13. All backfill and compaction as required. This shall include the backfill and compaction of all demolished structures and utilities and subsequent excavations left by their removal. All backfill shall be compacted to meet requirements set for in the geotechnical soils report.
 14. Proof roll the entire site once stripped of topsoil to determine locations of any unsuitable materials and remove.
 15. The site shall be maintained such that water will not be allowed to pond on the site or building pads.
 16. Construction of all building pads, with proper compaction, to within +/- one tenth of a foot of subgrade elevation.
 17. Establish, protect and maintain all excavations and slopes to provide a safe work area.
 18. Install a minimum of 6" of topsoil at all finished areas.
 19. Grade and construct all roads, sidewalks and curbs to subgrade elevation, +/- one tenth of a foot.
 20. Backfill and rough grade at all buildings, sidewalks, curbs, roadways, planters, and any other area that may be required.
 21. Coordinate location of spoil piles with other trades. All spoil piles are the responsibility of this Contractor.
 22. Provide and install all granular fill (aggregate base) at all areas receiving asphalt paving. Coordinate this work with the Asphalt Contractor. All asphalt aggregate base shall be installed to within +/- 0.1'.
 23. Provide and install all aggregate surface
- E. Division 3 Concrete
1. Provide and install all concrete required for the project. This shall include all labor, materials, equipment and supervision necessary to install a complete concrete package inclusive of building and site concrete. This work shall include, but not limited to, the following:
 2. Provide all surveying and layout required to complete the work of this category. This includes the establishment of a benchmark and control on site.
 3. Form, place, and finish all concrete footings, foundation walls, stoop turndowns, frost walls, column pads, retaining walls, and piers including all associated reinforcing steel as indicated or required. Provide all dowels required to anchor masonry walls to allow for lap lengths specified. Note vertical reinforcing requirements at security walls. Provide and maintain rebar caps on all dowels until fully embedded in masonry.
 4. Form, place and finish all interior and exterior concrete slabs, slabs on deck, precast concrete topping slabs, concrete stoops/turn-downs, and thickened slabs including all

- vapor barriers, expansion joint material, bond breaker material, control joints, associated dowels, wire mesh, and all other steel reinforcing. Assure curing method selected is compatible with floor finishes specified and provide complete coordination with all floor finishes. FF/FL testing within 24 hours after finishing is to be provided by this contractor. Provide bonding agent between precast concrete plank and topping slabs. This contractor shall be responsible for preparing substrate to receive concrete (examples include vacuuming, sweeping, cleaning, or drying precast or metal substrate.) Recess concrete floor slabs at all tile locations to allow tile to flush out with adjacent flooring.
5. Provide all excavation, backfill, compaction, and grading associated with completion of this bid category including building and site concrete. Provide all granular base fill and fine grading under concrete provided as part of the work of this category. Provide final compaction of the exposed top surface of stone columns using hand operated mechanical equipment.
 6. Provide all miscellaneous cast in place concrete items such as benches, beds, wall caps, concrete shower curbs, locker bases, etc.
 7. Provide and install all hooked dowels at precast concrete.
 8. Coordinate installation of all concrete wall/slab/grade beam penetrations with Earthwork, HVAC, Plumbing, Fire Protection, Security Electronics, and Electrical Contractors. Sleeves for penetrations will be furnished and laid out by others for installation in formwork by this contractor.
 9. Provide all water stop, chamfers, and other concrete accessories as indicated, specified, or required for completion of this category.
 10. Provide positive drainage on all floors with floors drains and provide slope from room perimeter where indicated. Coordinate with flooring trades and plumbing contractor.
 11. Contractor will be responsible for removing and replacing any new concrete that is deemed to not meet the contract documents through independent testing as well as any concrete that fails due to improper protection from weather conditions.
 12. Form, place and finish all exterior mechanical and electrical equipment pads (Generator and Chiller pads). Coordinate the work for the proper size and layout of the pads with the Mechanical & Electrical Contractors. All interior concrete equipment pads shall be installed by the Contractor associated with that work.
 13. Provide all temporary weather general conditions associated with completion of this scope of work including snow removal within the building footprint, ground thawing, and all cold and hot weather concrete procedures and protection as well as rain protection.
 14. Dewatering and mucking of excavations shall be the responsibility of this Contractor.
 15. Layout and set all anchor bolts provided by Structural Steel Contractor. Grout all base plates after columns are set and elevations are finalized by Structural Steel Contractor. Provide asphalt-mastic paint on portions of columns below grade according to structural details.
 16. Finish all concrete slabs to the required finish standards. This shall include meeting all levelness and flatness criteria and installing required sealers.
 17. Include all hoisting and placement equipment necessary to install all concrete.
 18. All underslab vapor barrier shall be included.
 19. All precautions (blankets, admixtures, heat, etc.) for cold weather concrete according to ACI and/or industry practice shall be included.
 20. Installation of all embedded plates, angles and other misc. steel shall be included. Embeds

- are provided by others
21. All exposed concrete shall be rub finished
 22. Grouting of all base plates after steel erection shall be included.
 23. Provide all concrete for pan fill stair treads and landings. This work will be completed as soon as possible as stairwells become erected. Provide all interior and exterior cast in place concrete stair systems complete.
 24. Provide all site concrete and associated reinforcement as indicated per the documents. Site concrete includes, but not limited to all concrete paving, sidewalks, curb & gutter, mow strips, maintenance strips, screen walls, security walls; security bollards, signs and sign bases, stoops, curbs, pads, ramps, approaches flagpole bases, etc. Provide concrete encasement for bollards, pedestals, signage, etc. Provide all steel bollards for this work and install. Provide barrier free textured warning surfaces at ADA ramps where indicated.
 25. Where building concrete is to remain exposed patch if needed to provide a uniform surface suitable for finished materials.
 26. Provide recessed insulated floor system under walk-in cooler/freezer.
 27. Concrete wash out area will be created and maintained by this contractor.
 28. Provide and install all granular fill at cast-in-place benches. Reference detail 14/S-531 as an example.
 29. Provide and install all concrete curbs at openings in precast planks.

F. Precast Concrete & Prestressed Hollow Core Slabs

1. Provide and install/erect all precast structural concrete and precast prestressed hollow core concrete. Include engineering, fabrication, shipment, delivery, equipment, grouting and all misc. steel required as part of a complete engineered system. Provide all reinforcing integral to precast. Provide all steel embeds for attachment of other building systems. Carefully review architectural and structural drawings for locations where embeds are required. Specifically note embeds associated with mezzanine, stair attachments, and steel pour stops. All reinforcing between precast and masonry above is to be provided by the contractor of this bid category.
2. Provide all engineering and design as required by the contract documents. Coordinate drawings with all other contractors for proper opening sizes and locations.
3. Accommodate all openings, structural elements, temporary access, etc. needed or required for the construction of this project.
4. Include knockout panels to allow access of all prefabricated cell units. Cell units are assumed to be double stacked in height. Coordinate this work with the DEC contractor for proper opening size and locations.
5. Coordinate all work with the Steel and Masonry Contractors to ensure proper bearing and locations for all work.
6. Provide all bearing pads for installation by others. This shall include detailed drawings indicating all embed locations.
7. Provide all miscellaneous precast accessories necessary to complete this scope of work including, but not limited to all bond break material, bearing pads, and slip pads, shims, hangers, clips, anchors, etc.
8. Prior to site mobilization, coordinate the installation of all work with the Construction Manager and other onsite contractors. Installation of precast will need to be coordinated with the Steel and Masonry contractors for proper installation of all work by each trade.
9. Provide and install all reinforcing extending from precast panels and/or hollow core planks.

- This shall include all reinforcing at knockouts of hollow core planks and the grouting in place of all reinforcing.
10. Provide all embeds for precast concrete and hollow core slabs at masonry and cast-in-place concrete for installation by others. Provide layout drawings for proper installation and location of each embed.
 11. Provide and install all steel embeds in precast units for bearing of other work. This would include, but not limited to, embeds for structural steel, miscellaneous steel, metal joist, metal decking, stairs, etc.
 12. At beam and/or joist pockets, construct the pocket large enough for the proper installation/welding of the support member.
 13. Weld precast embeds to support steel where applicable.
 14. Grout all gaps, keyways, cracks, voids, plank cores, and lifting openings as shown and as required for a complete system. Provide and remove all temporary grout stops and patch holes made by grout stops and/or remove excess spray foam to prepare for subsequent finishes.
 15. Assume multiple mobilizations may be required due to differing areas of construction and coordination between trades.
 16. Provide, install and remove all temporary bracing required for the proper installation of this work. All bracing shall be installed to fully support this work until such time as the remaining structure is complete. This includes providing and installing and removing any/all deadmen required for proper bracing. Following final connections, all shoring and bracing and deadmen shall be removed and any holes or damaged surfaces shall be repaired to match the surrounding finish. Coordinate all shoring installations to not inhibit the erection of precast concrete, structural steel or masonry walls.
 17. Provide for any MEP rough-in in precast plank cores. Coordinate locations to leave cores open for rough-ins. Notch planks in the field during installation where rough-ins will extend beyond top of masonry walls at bearing locations.
 18. Provide field verification prior to mobilization of all bearing wall locations, elevations, and conditions. Immediately notify CM of any unacceptable conditions.
 19. Provide OSHA compliant hole covers for all openings in precast 2" and bigger and leave covers in place after each erection sequence. Hole covers will be maintained and removed by others.
 20. Design additional capacity to support masonry as indicated on the structural framing details.
 21. Provide field patching of all exposed precast surfaces. Include multiple mobilizations to provide field patching in addition to precast erection mobilizations required per this scope of work.
 22. Provide winter conditions associated with erection of precast during the winter including heating substrate, snow and ice removal from bearing walls, and heating grout as well as all other winter conditions necessary.
 23. This contractor will be responsible for providing temporary fall protection guard rails around the entire perimeter of all areas of precast concrete plank. Install temporary fall protection immediately after erection sequence to make safe for subsequent trades to avoid the need for tie-off. Fall protection is to comply with OSHA requirements. Provide removable sections to allow for movement of materials and removal of trash and debris to precast levels. Remove temporary fall protection when directed by CM and patch exposed substrate to prepare for finishes.

G. Storm Sewer System

1. Provide and install a complete and operational storm sewer system as defined by the contract documents. This shall include all piping, drywells, castings, sealants, bedding, backfill, excavation, testing etc. for a complete and operational system.
2. Include all required excavation, backfill, bedding materials and compaction as required by the contract documents for storm sewers
3. Install all castings as indicated for the storm sewer system.
4. Provide all required State and Federal safety measures for this work. Should any unsafe work activity be observed, Garmong will halt all work until the unsafe condition is abated.
5. Provide all required testing of piping systems. Coordinate this with all local authorities having jurisdiction.
6. All piping shall be run to within 5'-0" of the building footing wall. Provide final connections.
7. Ensure all storm sewer installations maintain proper clearances from sanitary sewer piping and water mains.
8. Provide as-built drawings for all storm sewer installations.
9. Install all under drains, perimeter drains and foundation drains, as indicated.
10. Route storm piping to all downspout locations. Provide a "turn up" connection sized for the downspout specified for each location.

H. Stone Columns

1. Design, provide and install a complete stone column system. This shall include all labor, materials, equipment and supervision required for a complete system. This work shall include but is not limited to the following:
2. Engineer stone columns as required by the contract documents. Shall include a licensed engineer in the state of Indiana to approve and stamp the drawings.
3. Contractor will be responsible for all layout of this work.
4. All pier installations shall occur approximately 1'-0" above final grades.
5. Contractor shall work with the soils testing inspector to ensure all loading is achieved. Record documents of all installation shall be provided at the end of the project to verify a successful installation. This shall include as-built drawings indicating center of pile locations, and top/bottom elevations of all columns.
6. Any corrections needed due to incorrect placement, installation or design shall be the responsibility of this Contractor.
7. Storage and stockpiling of materials will be coordinated so to not affect ongoing work elsewhere on the site. Contractor shall include all necessary hauling of materials not only to the site, but on the site as well.

I. Landscaping

1. Provide and install all landscaping as indicated by the contract documents. This shall include all labor, materials, equipment and supervision for a complete and professional landscape installation.
2. This work shall include all seeding, mulch, plants, trees, bushes, flowers, site amenities, benches, trashcans, etc.
3. All topsoil shall be tested for soil nutrient characteristics and amended for the intended plant growth.
4. Provide and install all grass pavers. This shall include all stone subgrade, pavers, sand, etc. for a complete system.
5. Install all erosion control measures necessary to ensure proper growth of grass and eliminate soil erosion. Remove these protections upon establishment of seed growth.

6. Include watering of plantings until establishment.
7. Provide and install all chain link fencing, site fencing, security fencing, decorative metal security fencing, gates, chain link overhead security barriers and barbed tape including all chain link fence fabric fence framing, tension wire, barbed wire, grout, concrete, fence grounding, fittings, and hardware complete. Provide all mow strips along security fencing as indicated on fencing details sheet C105.
8. Provide and install all security bollards and associate work including all concrete & excavation work.
9. Provide and install the louvered screen panel system alternate.
10. Provide and install the smoking shelter
11. Provide and install all outdoor furniture. This includes the tables, chairs, benches, etc.

J. Division 6 Work

1. Deleted per Addendum No. 3
2. Deleted per Addendum No. 3
3. Deleted per Addendum No. 3
4. Deleted per Addendum No. 3
5. Deleted per Addendum No. 3
6. Deleted per Addendum No. 3
7. Deleted per Addendum No. 3
8. Provide and install all building expansion joints. Roof expansion joints will be provided and installed by the roofing Contractor.
9. Provide interior trim and shelving including clothes rods, blocking, anchors, adhesives, joint sealants, putty, and accessories as indicated and required for a complete system. Provide prefinished hardware where indicated; include wire shelving if shown.
10. Provide and install all access flooring. Provide all cutouts for grilles, equipment and furniture that may be required.

K. Division 7 Work

1. Waterproofing, weather barriers, perimeter insulation, EIFS, vapor retarders, fireproofing, intumescent fireproofing, firestopping, preformed joint seals, and sealant per the Contract Documents.
2. Provide all reinforcing, mesh, surface preparation, etc. necessary for the proper adhesion of all fireproofing materials to the surfaces and/or structures they are being applied to.
3. Fire Protection Contractor, Mechanical Contractor, and Electrical Contractor are responsible for firestopping wall penetrations in rated walls and smoke tight partitions.
4. Prepping of substrates for application of fireproofing. Contractor shall notify Garmong in writing prior to application of fireproofing of any surface that is not acceptable. Start of work shall be acceptance of surfaces by this Contractor.
5. Provide and install all sealants as indicated or required herein. This shall include but not limited to the following:
 - a. Precast joints
 - b. Masonry control joints
 - c. Casework and millwork including countertops, backsplashes and trims to themselves or dissimilar materials.
 - d. Security caulking
 - e. EIFS control joints
 - f. Door frames (walls and floor).

- g. Caulking of all storefront is included in this scope of work. This includes all interior and exterior caulking including floors.
 - h. Expansion joint caulking
 - i. Control joint caulking
 - j. Sidewalk joints
 - k. Caulking of plumbing fixtures
 - l. Caulking of tile to countertops
 - m. Caulking of lab casework.
 - n. Plumbing fixtures
 - o. Site concrete paving
6. All sealants to match adjacent surfaces.
- L. Division 8 Work
- 1. Provide all non-detention hollow metal doors and frames including all anchors, glazing, and accessories. Any frames not on site in time for masonry will be left open and this category will pay mason's premium to tooth-in frame. The Masonry Contractor will grout frames.
 - 2. Provide installation only of all Security access doors and frames. Security doors will be furnished by the detention equipment contractor
 - 3. Provide all flush wood doors complete where indicated including all glazing and accessories. Provide protection to cover wood doors after installation.
 - 4. Provide door position indicator device compatible with security electronics system. Provide complete engineered system that meets performance criteria from the contract documents.
 - 5. Coordinate electrified controls with DEC and Electrical Contractors prior to ordering doors to ensure proper operation with electrical and security electronics systems.
 - 6. Provide all non-detention door hardware in openings provided as part of this bid category as well as all non-detention door hardware in security openings. Refer to all pages of the contract drawings for locations of automatic door operators and push pads provided as part of this scope of work (specifically electrical drawings). Electrified non-detention hardware is to be wired and terminated by the Electrical Contractor. Provide construction keying in exterior non-detention door openings. Provide all permanent keying in non-detention door openings provided as part of this scope of work coordinated with owner, CM, Architect, and lock supplier. Provide all key controls including key management system, key cabinet, and fire department lock box.
 - 7. Include all hoisting and transportation for the delivery and installation of doors, frames and hardware
 - 8. Contractor shall install all hollow metal frames under this scope. Care should be taken to insure that frames are installed in a true, level, square and plumb fashion. This Contractor shall remove hollow metal frame spreaders.
 - 9. Ensure all frames are true, level, square and plumb following framing and drywall activities. Any repairs will be made by this Contractor
 - 10. Install all Doors and Door Hardware complete and ready for operation. All access door hardware will be supplied and installed by this Contractor. This work shall be coordinated with the Electrical Contractor to interface with the security systems.
 - 11. All required final hardware adjustments and punching out of the work as required for a properly functioning system at the time of Substantial Completion and Owner acceptance is included.
 - 12. Contractor shall be responsible for protection of all hardware and wood doors until

- installed and accepted by the Construction Manager. Removal of shipping protection materials and depositing in the job site dumpsters is included in this scope of work.
13. Coordinate keying and installation of cores with the Owner and Garmong. Contractor will install all cores as per their direction.
 14. Provide any/all access doors indicated on the reflected ceiling drawings. All access doors not shown but required for Mechanical, Plumbing or Electrical access will be provided and installed by the Contractor requiring the access door
 15. Install only all detention door frames, tear gas ports, chase doors and security access doors furnished by Detention Equipment Contractor. DEC will provide on-site training before beginning this work. General Trades contractor is to receive, unload, inspect, maintain inventory, and protect detention frames prior to installation. Frames are to be delivered prior to the start of above grade masonry and stored by the General Trades Contractor until installed. Where frames are delivered in sections due to shipping limitations or where detention frames are to be installed tight to other frames and structural steel, this contractor will be responsible for welding frames together and installation of Bondo to provide a seamless installation. Coordinate with DSC. Frames will be grouted by the Masonry Contractor. The General Trades contractor will be required to Bondo over grout holes where required to grout frames under steel framing.
 16. All non-detention doors and frames identified to receive detention glazing are to be provided with 1-1/4" glazing stops and rabbits that provide 1" of bite on detention glazing to maintain the warranty from the detention glazing manufacturer.
 17. At non detention openings provided as part of this scope of work, provide all wiring pigtails within door panels.
 18. Provide and maintain in base bid (4) temporary doors and framing for construction access into the building through the exterior skin of the building, approximately 12'x12'. Remove these doors and framing as directed by the CM. It is assumed that these temporary doors
 19. Provide and install all Aluminum Framed Entrances and Storefront, Aluminum Curtain Walls, labor, material, equipment, supervision and services required for complete and operational, Glass & Aluminum Windows, Doors, Storefront, Fiberglass Sandwich Panel Assemblies and Glazing work, including but not limited to:
 - a. Provide all aluminum entrances and storefront systems. This shall include all interior and exterior aluminum systems.
 - b. Provide all aluminum headers, soffits, closures, and extensions of material within plane of window/storefront systems to close building envelope.
 - c. Automatic entrances as indicated. This includes automatic door operators and sliding doors.
 - d. Flashings, sill trim, weeps, etc. – All assemblies as required ensuring performance against water infiltration in accordance and in coordination with exterior wall consultant's recommendations.
 - e. Provide and install all glass. This shall include all vision, mirrors, decorative, spandrel, interior and exterior glass.
 - f. All skylights with fiberglass sandwich-panel assemblies
 20. Provide temporary protection of window, glazing, frames, doors, and storefronts.
 21. This Contractor shall remove all dirt, grease, stickers, glue, and markings when directed by the Garmong project superintendent prior to turnover.
 22. All glass and glazing including glazing of wood and hollow metal doors, frames and windows is included in this scope. This includes filling nail holes in wood door stops.
 23. Provide finish of aluminum as specified, including powdered coating systems.

24. Provide and install all door hardware as specified in the contract documents.
25. Contractor shall reinforce all door and frame components as required to receive and support the hardware application as specified.
26. Coordinate and assist with install of all electronic systems.
27. Contractor shall be responsible for providing any and all additional supports not shown on the drawings to meet requirements of the work.
28. It is the responsibility of this Contractor to coordinate all rough openings with other trades.
29. Shop drawings will show opening dimensions for preparation by the other trades. This Contractor shall include a system to accommodate the standard industry tolerances for these abutting trades.
30. Provide and install all overhead coiling doors and all sectional doors including manual and electric door operators.
31. Provide and install all electrical terminations to the equipment for overhead and sectional doors. This Contractor will be responsible for providing and installing all low voltage wiring and switches.
32. Coordinate work with Electrical Contractor for proper installations.
33. Contractor shall coordinate door opening sizes and verify opening size and equipment clearance requirements. Modifications to the structure due to incorrect clearance requirements shall be this Contractor's responsibility.

M. Division 10 Work

1. Provide and install miscellaneous specialties, including, but not limited to visual display units, signage, lettering, toilet compartments and accessories, welding curtains, fire extinguishers, lockers, evidence lockers, wall protection, shelving, mobile storage shelving, lockbox, canopies, and flagpoles. Work shall include all fasteners, adhesives, blocking, etc.
2. Signage per Contract Documents, including foundation for post and panel/pylon signage.
3. Coordinate structural support for welding curtains with Structural Steel Contractor.
4. Install furnished detention toilet and bath accessories where embedded in masonry.

N. Division 11 Work

1. Provide and install all package transfer units, gun lockers, and inmate property packaging equipment. Include anchorage devices and fasteners for complete installation.
2. Coordinate electrical requirements with Electrical Contractor.

O. Division 12 Work

1. Provide and install all manufactured laminate casework, solid surface materials, stainless steel cabinets & countertops, sills, backsplashes, end splashes, wall caps, undercounter knee protection, countertops, and closet and utility shelving as indicated and required including blocking, shims, wood stud framing, mounting hardware, countertop support brackets, and accessories. Coordinate locations with flooring, plumbing, mechanical, and electrical contractor. Cut all openings in casework and countertops for electrical and data devices, plumbing fixtures, and piping located behind casework for electrical and data devices. Protect all casework and countertops, using cardboard protection, after installation and remove protection at project completion. Grommets in countertops to be located in the field and installed by this contractor following Owner equipment move-in.
2. Include integral bowls as indicated.
3. Contractor shall provide all additional stiffeners as may be required for the proper

performance of the work.

4. Contractor shall field verify all dimensions.
5. Contractor shall include final adjustments of all drawers, doors, and other hardware as may be required by the Architect and/or Garmong.
6. Contractor shall remove, as part of this scope, all manufacturers' labels, stickers, etc. at the conclusion of the contract. Final cleaning of all work is included.
7. Provide and install all window stools.
8. All millwork details and returns shall be as per architectural details unless mutually agreed to and approved on shop drawing submissions.
9. Provide and install all window coverings.
10. Provide and install metal countertops.
11. Provide and install fixed beam seating and institutional furnishing including security fasteners for a complete installation.
12. Provide and install all site furnishings.

Addendum No. 2 Revisions – The following items are to be added to this scope of work:

1. Delete Specification Section 09 84 10 Fixed Sound Absorbing Panels from this scope of work.
2. Delete Specification Section 125600 Institutional Furniture from this scope of work.

Addendum No. 3 Revisions – The following items are to be added to this scope of work:

1. In paragraph J Division 6 Work, delete items 1-7 from this scope. All wood blocking shall be installed by Bid Package 6. Coordinate all required blocking requirements with this contractor.
2. All pavement markings shall be provided and installed by Bid Package 2.
3. All hand-painted signage shall be by Bid Package No. 7 Painting.
4. Include revised specification 316500 Engineered Aggregate Piers issued in Addendum No. 2
5. Delete Specification Section 111736 Package Transfer Unit from this scope of work
6. Delete Specification Section 111916 Detention Gun Lockers from this scope of work.
7. Delete Specification Section 112923 Inmate Property Packaging Equipment from this scope of work
8. Delete Specification Section 125283 Fixed Beam Seating form this scope of work
9. Include in this scope of work a construction allowance of \$150,000 to be utilized as directed by the Construction Manager.
10. Add Specification Section 033616 Reactive Chemical Stain to this scope of work. Provide and install all work associated with this specification.
11. Provide and install all sealed concrete.
12. Add Specification 042113 Brick Masonry to this scope of work. Provide and install all thin brick associated with the precast concrete panels.

END BID CATEGORY BP NO. 1 GENERAL TRADES SCOPE OF WORK

BID CATEGORY BP NO. 2 ASPHALT PAVING SCOPE OF WORK

This Scope of Work is to include, but is not limited to, the following Specification Sections:

<u>Section</u>	<u>Description</u>
Division 00	Procurement and Contracting Requirements
Division 01	General Requirements
32 12 16	ASPHALT PAVING
32 17 13	PARKING BUMPERS
32 17 23	PAVEMENT MARKINGS

This Bid Category Scope of Work describes and assigns Work to this Bid Category as designated by the Construction Manager. Each Contractor shall cooperate and coordinate with all other Bid Category Contractors for proper and expedient completion of the Work in this Project. This summary should in no way be construed as being all inclusive. It is issued as a guide to aid in the assignment of Work and is intended to clarify and/or further define the Scope of Work included in the Bid Documents. They shall not be construed as the entire Scope of Work for this Bid Category. All work described or indicated in the respective Specifications Sections or Divisions listed above shall be included, except as specifically excluded herein.

1. Provide all labor, material, equipment and supervision to complete the ASPHALT PAVING scope of work.
2. This contract is to provide and install all asphalt in accordance with the plans and specifications including fine grading of stone.
3. This contract to provide and install asphalt in accordance with the plans and specifications including fine grading of stone placed by the Site Development Bid Package.
4. Provide and install all pavement marking all parking blocks and all parking ADA signs, road signs, directional signs in accordance with the plans and specifications. – Revised per Addendum No. 3
5. Contract is responsible to keep positive slope to drains. Any issues advise immediately for engineer review.
6. All work associated with entrance road from Honey Creek Drive to the project site as indicated in Areas “E” and “F” on the Site Development drawings

Addendum No. 3 Revisions – The following items are to be added to this scope of work:

7. Revised Item 4: All pavement markings, parking bumpers and signage shall be provided and installed under this bid package.
8. Include in this scope of work a construction allowance of \$15,000 to be utilized at the direction of the Construction Manager.

BID CATEGORY BP NO. 2 ASPHALT PAVING SCOPE OF WORK

BID CATEGORY BP NO. 3 MASONRY SCOPE OF WORK

This Scope of Work is to include, but is not limited to, the following Specification Sections:

<u>Section</u>	<u>Description</u>
Division 00	Procurement and Contracting Requirements
Division 01	General Requirements
04 21 13	BRICK MASONRY
04 22 00	CONCRETE UNIT MASONRY
04 72 00	CAST STONE MASONRY

This Bid Category Scope of Work describes and assigns Work to this Bid Category as designated by the Construction Manager. Each Contractor shall cooperate and coordinate with all other Bid Category Contractors for proper and expedient completion of the Work in this Project. This summary should in no way be construed as being all inclusive. It is issued as a guide to aid in the assignment of Work and is intended to clarify and/or further define the Scope of Work included in the Bid Documents. They shall not be construed as the entire Scope of Work for this Bid Category. All work described or indicated in the respective Specifications Sections or Divisions listed above shall be included, except as specifically excluded herein.

1. Provide all labor, material, equipment and supervision to complete the MASONRY scope of work.
2. The Scope of Work includes laying to all hollow metal frames in masonry wall construction. Material will be furnished by others. Grouting of hollow frames is included in this Scope of Work. This Contractor shall ensure frames are plumb, level, and square before, during and after installation of work.
3. Contractor will remove all mortar and grout from hollow metal frames upon completion of work.
4. Contractor shall protect the inside of all masonry hollow metal frames at the hinges and strikes to keep out mortar.
5. Grout and mortar testing will be by others. Testing shall be schedule with Garmong 24 hours in advance. All cost associated with a failed test will be the responsibility of this Contractor.
6. Provide in place mock-up as required by Garmong and the Owner. Mock-ups shall include the specified mortar and accessories.
7. This Contractor shall be responsible for any additives, heating of materials, and covering of work in place for cold weather conditions.
8. Clean up of mortar droppings and masonry debris from masonry operation shall be performed continuously and immediately following the laying of the work and the area shall be left broom clean.
9. This Contractor will employ a competent scaffold erector with OSHA certification, who will supervise and monitor all scaffolding work and will be onsite when all scaffolding work is in progress or being used. A tagging system must be used to identify out of service and in service scaffolding. The tagging system will be per OSHA requirements.
10. Contractor shall install rebar caps (OSHA Approved) on all reinforcing and maintain daily.
11. If the toilet accessories, fire extinguisher cabinets, valve cabinets, electrical panels, etc. are not delivered in time, provide block outs for these items as per submittal data.

12. Provide washout of excess concrete associated with masonry work to be performed on site at a location directed by Garmong project management. Clean up of this area will be performed by this Contractor weekly.
13. The Contractor shall coordinate with Garmong and other trades, and install sleeves and embedded items built into masonry walls, i.e. expansion joints, metal embeds, etc.
14. This Contractor is responsible to furnish, install, and remove any necessary temporary wall bracing to prevent failure due to wind, etc.

Addendum No. 2 Revisions – The following items are to be added to this scope of work:

15. Provide and install all firestopping at the perimeter of masonry walls. This shall include all fire and smoke sealants.
16. Provide and install all compressible fillers in masonry walls.

Addendum No. 3 Revisions – The following items are to be added to this scope of work:

17. Include in this scope of work a construction allowance of \$20,000 to be utilized as directed by the Construction Manager.

BID CATEGORY BP NO. 3 MASONRY SCOPE OF WORK

BID CATEGORY BP NO. 4 STRUCTURAL STEEL SCOPE OF WORK

This Scope of Work is to include, but is not limited to, the following Specification Sections:

<u>Section</u>	<u>Description</u>
Division 00	Procurement and Contracting Requirements
Division 01	General Requirements
05 05 53	SECURITY METAL FASTENINGS
05 12 00	STRUCTURAL STEEL FRAMING
05 12 13	ARCHITECTURALLY EXPOSED STRUCTURAL STEEL FRAMING
05 21 00	STEEL JOIST FRAMING
05 31 00	STEEL DECKING
05 50 00	METAL FABRICATIONS
05 51 19	METAL GRATING STAIRS
05 52 13	PIPE AND TUBE RAILINGS
05 53 00	METAL GRATINGS

This Bid Category Scope of Work describes and assigns Work to this Bid Category as designated by the Construction Manager. Each Contractor shall cooperate and coordinate with all other Bid Category Contractors for proper and expedient completion of the Work in this Project. This summary should in no way be construed as being all inclusive. It is issued as a guide to aid in the assignment of Work and is intended to clarify and/or further define the Scope of Work included in the Bid Documents. They shall not be construed as the entire Scope of Work for this Bid Category. All work described or indicated in the respective Specifications Sections or Divisions listed above shall be included, except as specifically excluded herein.

1. Contractor agrees to furnish all scaffolding, associated rigging, hoisting (crane), unloading, handling, unpacking, and services necessary for erection and delivery into the premises of all necessary equipment and apparatus. Contractor agrees to remove it from premises when no longer required for the performance of this work required to perform the work of this Subcontract is included.
2. Temporary barricades as required per 01 56 23 – Barricades.
3. The Contractor will furnish F.O.B. jobsite all embeds for cast in place concrete and masonry anchor bolts for structural steel and special metal fabrications that are required or shown to be cast in concrete or masonry. All embeds will have holes drilled for attachment to formwork.
4. Provide all necessary fasteners, clips, inserts, embeds, templates, accessories, hanger rods, pre-punched holes, etc. to furnish and install all structural steel as required.
5. Provide certificates for all welders, prior to start of work.
6. Include touch up (chipping, grinding and prime painting) of all structural steel and field welds. All embeds are to be prime painted on all surfaces.
7. Furnish and install all temporary and permanent cross bracing, wind bracing and misc. bracing as required.

8. Furnish all steel lintels and brick relieving angles as required. Contractor shall provide all necessary anchors to attach these members
9. Provide all painting, touch-up painting, bituminous coatings and galvanizing as required.
10. In the event of mis-fabrication or design error, the supplier will submit, within 24 hours, an engineered solution. Upon acceptance, Contractor will immediately correct the problem as necessary not to interfere with the job progress.
11. No cutting or drilling of holes in structural members will be permitted unless written permission from the Design Team is obtained.
12. Special attention is to be made to all OSHA and Garmong Safety Requirements, especially to TYING OFF. Scaffolds, ladders, hard hats, safety glasses, fire extinguishers and flash arrestors will be used. Ladders must be tied off. All personnel setting "leading edge" work will be tied off, NO EXCEPTIONS. This Contractor shall design and install any necessary safety cable system required to achieve compliance. The company safety director prior to use will review all systems. 100% fall protection above 6' will be strictly enforced.
13. All welders are to be gas or diesel powered.
14. All welds in galvanized decks will be touched up with galvanized primer.
15. This Contractor is responsible for any lost or misplaced materials intended for this scope of work.
16. Provide all metal fabrications as indicated and specified including steel framing and supports for operable partitions, overhead doors and grilles, countertops, doors and windows, MEP equipment, shelf angles, miscellaneous steel trim and corner guards.
17. Provide all steel closure plates, beam enclosures, steel bulkheads, steel soffits, steel utility enclosures, steel plate supports above security mesh screens at mezzanines as indicated. These items are to be fabricated and installed with no gaps larger than 1/8". Provide removable access sections in all steel bulkheads, soffits, and ceilings per specification, but no less than every 12' and a minimum of one (1) per straight run enclosure. Provide all openings for MEP penetrations including HVAC grilles, fire suppression heads, as well as lights and steel mounted electrical and security devices. Coordinate framing members with MEP utilities above ceiling and within steel bulkheads, soffits, and beam enclosures.
18. Provide metallic putty sealants at items provided as part of this scope of work where the work remains exposed. This contractor will be required to seal all exposed joints in steel soffits, bulkheads, ceiling, beam enclosures, and mezzanine plates.
19. Provide angle and plates required for dock leveling equipment and enclosures.

Addendum No. 2 Revisions – The following items are to be added to this scope of work:

20. All stairs, handrails, guardrails, grating, mezzanine steel, etc. located in the Day Rooms shall be furnished and installed by Bid Package No. 13. All other stairs, handrails, guardrails, grating mezzanine steel etc. shall be furnished and installed by this bid package.

Addendum No. 3 Revisions – The following items are to be added to this scope of work:

21. Include in this scope of work a construction allowance of \$15,000 to be utilized as directed by the Construction Manager.

BID CATEGORY BP NO. 4 STRUCTURAL STEEL METALS SCOPE OF WORK

BID CATEGORY BP NO. 5 ROOFINGSCOPE OF WORK

This Scope of Work is to include, but is not limited to, the following Specification Sections:

<u>Section</u>	<u>Description</u>
Division 00	Procurement and Contracting Requirements
Division 01	General Requirements
07 42 43	MODULAR METAL WALL, ROOF AND SOFFIT PANELS
07 54 23	THERMOPLASTIC POLYOLEFIN (TPO) ROOFING
07 62 00	SHEET METAL FLASHING AND TRIM
07 71 00	ROOF SPECIALTIES
07 72 00	ROOF ACCESSORIES
07 72 13	MANUFACTURED ACCESS CURBS AND COVERS FOR CONVENTIONAL ROOFS – Rev. ADD #3
07 72 53	SNOW GUARDS

This Bid Category Scope of Work describes and assigns Work to this Bid Category as designated by the Construction Manager. Each Contractor shall cooperate and coordinate with all other Bid Category Contractors for proper and expedient completion of the Work in this Project. This summary should in no way be construed as being all inclusive. It is issued as a guide to aid in the assignment of Work and is intended to clarify and/or further define the Scope of Work included in the Bid Documents. They shall not be construed as the entire Scope of Work for this Bid Category. All work described or indicated in the respective Specifications Sections or Divisions listed above shall be included, except as specifically excluded herein.

1. Coordinate work with the work of all other bid packages.
2. Coordinate with mechanical and electrical bid packages for roof installation around roof top units and penetrations.
3. Furnish and install all joint sealants as it relates to roofing. These sealants should be utilized to ensure water tightness and included as part of the overall roofing system.
4. Coordinate roof penetrations with all bid packages and ensure that all penetrations conform with the roof systems installation requirements. Provide all material necessary to seal these penetrations.
5. All required roof vents complete with curbs, water seals, gaskets and hardware, flashing and accessories.

Addendum No. 3 Revisions – The following items are to be added to this scope of work:

6. Renamed specification section 077129 to 077213 Manufactured Access Curbs and Cover for Conventional Roofs.
7. Provide and install all roof hatches. This shall include all curbs, blocking and flashings.
8. Provide and install all roof curbs required for the items installed under this scope of work. All other trades, i.e. Mechanical, Electrical, etc. are required to provide curbs associated with their work.
9. Include in this scope of work a construction allowance of \$10,000 to be utilized as directed by the Construction Manager.

BID CATEGORY BP NO. 5 ROOFING TEMPLATE SCOPE OF WORK

BID CATEGORY BP NO. 6 METAL STUDS, DRYWALL & ACOUSTICAL CEILINGS SCOPE OF WORK

This Scope of Work is to include, but is not limited to, the following Specification Sections:

<u>Section</u>	<u>Description</u>
Division 00	Procurement and Contracting Requirements
Division 01	General Requirements
05 40 00	COLD-FORMED METAL FRAMING
06 10 53	MISC. ROUGH CARPENTRY
06 16 00	SHEATHING
07 21 00	THERMAL INSULATION
07 25 00	WEATHER BARRIERS
09 22 16	NON-STRUCTURAL METAL FRAMING
09 29 00	GYPSON BOARD
09 51 13	ACOUSTICAL PANEL CEILINGS
09 57 53	SECURITY CEILING ASSEMBLIES Delete per Addendum No. 2
09 84 10	FIXED SOUND ABSORBING PANELS - Added per Addendum No. 2

This Bid Category Scope of Work describes and assigns Work to this Bid Category as designated by the Construction Manager. Each Contractor shall cooperate and coordinate with all other Bid Category Contractors for proper and expedient completion of the Work in this Project. This summary should in no way be construed as being all inclusive. It is issued as a guide to aid in the assignment of Work and is intended to clarify and/or further define the Scope of Work included in the Bid Documents. They shall not be construed as the entire Scope of Work for this Bid Category. All work described or indicated in the respective Specifications Sections or Divisions listed above shall be included, except as specifically excluded herein.

1. Contractor shall provide additional bracing and/or backing required to adequately support all wall hung fixtures and equipment (cabinets, furniture, toilet accessories, tack boards, handrails, fire extinguisher cabinets etc.). Comply with stud manufacturers recommendations and industry standards in each case considering weight or load resulting from item supported. This Contractor will meet with each related Contractor to coordinate blocking and backing work.
2. Contractor shall furnish and install all acoustical sealants required.
3. Floors shall be scraped clean of drywall mud daily.
4. Contractor shall stencil and identify all fire rated and smoke partitions as required.
5. Contractor shall protect storefront, hollow metal work, aluminum work, glass etc. as required to prevent damage by Contractor's work.
6. Coordinate penetrations in drywall with appropriate trades. Ensure that drywall is cut ¼" to ½" between through wall penetrations. Seal joint with acoustical sealant as required. All penetrations shall be constructed in accordance with UL and NFPA requirements.
7. Other Contractors shall furnish all access panels. This Contractor is responsible for the complete installation of these access panels into partitions and walls constructed by this Contractor.

8. In the interest of a quality finished product and appearance, Garmong, along with the painting Contractor and this Contractor, will inspect all wallboard for surface defects after prime painting. This Contractor will perform any patching of drywall for corrections required. The painting Contractor will perform any associated repriming work. This work, both by the painting Contractor and this Contractor, shall be completed prior to the application of the finish coats of paint at no additional cost.
9. All drywall is to be finished to the floor to allow for the proper installation of base.
10. Provide cut outs necessary for framing at all electrical outlets, switches, HVAC, fire sprinkler and plumbing openings and all other trades where required. Verify height with plans, specifications, codes.
11. Provide coordination with the work of other trades and specifically participate in the ongoing coordination of MEP trades.
12. Coordinate with electrical and mechanical trades, the location of, the suspension reinforcement for, fixtures and/or mechanical grilles, etc. to coordinate with the ceiling suspension pattern. Provide additional ceiling supports and cut outs where necessary to support light fixtures, speakers and other ceiling mounted equipment
13. Coordinate the location of hangers with other work. Ensure the layout of hangers and carrying channels are installed to accommodate fittings and units of equipment that are placed after the installation of the ceiling grid system.
14. Where ducts and or other equipment prevent the regular spacing of hangers, reinforce the nearest and adjacent hangers and related carrying channels as required to span the distance.
15. Contractor shall install and cut all ceiling tile required except for the fire sprinkler tile.
16. If ceiling height discrepancies exist, this Contractor shall notify Garmong immediately. This Contractor shall not make any ceiling height changes without approval.
17. Contractor shall provide all required caulking, sealants and acoustical sealants.

Addendum No. 2 Revisions – The following items are to be added to this scope of work:

18. Add to this scope specification section 098410 Fixed Sound Absorbing Panels. Provide and install all fixed sound absorbing panels.
19. Delete Specification Section 095753 Security Ceiling Assemblies from this scope of work.

Addendum No. 3 Revisions – The following items are to be added to this scope of work:

20. Provide and install all wood blocking, wood sheathing, plywood, nailers, etc. required for the project.
21. Contractor shall provide and install all blocking, bracing and/or backing required to adequately support all wall hung fixtures and equipment (cabinets, lab casework, furniture, toilet accessories, tack boards, handrails, fire extinguisher cabinets etc.) specified on the contract documents. Comply with stud manufacturers recommendations and industry standards in each case considering weight or load resulting from item supported. This Contractor will meet with each related Contractor and the Construction Manager to coordinate blocking and backing work.
22. All blocking materials shall properly support the products being fastened to them.
23. Contractor shall supply to Garmong coordinated blocking drawings indicating all in-wall blocking required for anchoring the work. However, this shall in no way relieve the Contractor of its responsibility to properly secure the work of this scope.

24. Contractor shall furnish and install all fasteners, anchors, and miscellaneous accessories as required for the complete installation of the work of this scope.
25. Provide and install all wood blocking at the roof. Coordinate blocking depth with Roofing Contractor for proper depth and anchorage requirements.
26. Include plywood backboards for equipment. All plywood shall be smooth finish and painted black prior to equipment install.
27. Include any reinforcing for doors & frames.
28. Include all blocking at exterior openings in the building.
29. This contractor shall provide and install all exterior wall insulation. This shall include, but not limited to, all ridged board insulation, batt insulation, foam spray insulation, etc.
30. Include in this scope of work a construction allowance of \$20,000 to be utilized as directed by the Construction Manager.

BID CATEGORY BP NO. 6 METAL STUDS, DRYWALL & ACOUSTICAL CEILINGS SCOPE OF WORK

BID CATEGORY BP NO. 7 PAINTING SCOPE OF WORK

This Scope of Work is to include, but is not limited to, the following Specification Sections:

<u>Section</u>	<u>Description</u>
Division 00	Procurement and Contracting Requirements
Division 01	General Requirements
05 12 13	ARCHITECTURALLY EXPOSED STRUCTURAL STEEL FRAMING
09 67 23	RESINOUS FLOORING
09 67 25	SEAMLESS SHOWER COATINGS
09 72 00	WALL COVERINGS
09 91 13	EXTERIOR PAINTING
09 91 23	INTERIOR PAINTING
101423	PANEL SIGNAGE – added per Addendum No. 3
13 55 00	PREFABRICATED MODULAR STEEL CELLS
32 17 23	PAVEMENT MARKINGS (INT. STRIPING)

This Bid Category Scope of Work describes and assigns Work to this Bid Category as designated by the Construction Manager. Each Contractor shall cooperate and coordinate with all other Bid Category Contractors for proper and expedient completion of the Work in this Project. This summary should in no way be construed as being all inclusive. It is issued as a guide to aid in the assignment of Work and is intended to clarify and/or further define the Scope of Work included in the Bid Documents. They shall not be construed as the entire Scope of Work for this Bid Category. All work described or indicated in the respective Specifications Sections or Divisions listed above shall be included, except as specifically excluded herein.

1. Provide block fillers, metal fillers, primer, and finish coat material as required.
2. Contractor will be responsible for all surface preparation including, but not limited to, scraping, grinding, sanding, etc., prior to their application. Contractor shall notify Garmong in writing, prior to applying finish materials as to any surfaces that are not acceptable. Included is all required masking and protection of adjacent work including hardware, fixtures, millwork, flooring, sprinkler heads, etc. Start of work shall be acceptance of surfaces by this Contractor.
3. On any surface requiring more than one coat, Contractor shall not apply second or finish coat until it has received written acceptance of coating from Garmong.
4. Tint each undercoat a lighter shade when multiple coats of same material are applied. Tint undercoats in the same color range as the finish coat.
5. Provide samples of each color and material to be applied for approval by A/E on actual substrate prior to any production work, in strict accordance with contract specifications.
6. Come back work at the building exterior and interior is included at no additional cost.
7. The Contractor will clean adjacent surfaces that receive over spray.
8. Garmong will provide temporary lighting per OSHA standards only. Contractor shall provide all additional lighting required for the proper execution of work.
9. Finish exterior doors on tops, bottoms and side edges same as exterior faces.

10. Paint backsides of access panels, removable and hinged covers to match exposed surfaces.
11. Paint all cell module fronts and both sides of each cell door.
12. Paint mezzanine level walkways, hand-railing, and stairs, stair stringers, etc. The open grating of mezzanines and the open grate stair treads will remain galvanized and not painted. Paint all Kane Vantage wall materials.
13. Touch up primer on factory or shop primed metal surfaces required for application of finish painting.
14. The Contractor shall verify compatibility of materials applied to substrates field coated by this Contractor to not void the warranties of said materials. It is also the responsibility of the Contractor to verify compatibility of shop-applied coatings to topcoats applied in the field.
15. Contractor will not be allowed to clean tools and equipment in permanent plumbing fixtures.
16. All required cosmetic caulking, including caulking at casework, is included in this agreement.
17. Contractor shall be responsible for painting mechanical and electrical work exposed to view in interior occupied spaces and exterior walls and roof.
18. The Painting Contractor, Masonry Contractor and Metal Stud/Drywall Contractor will inspect all gypsum wallboard, plaster and block walls after prime painting for surface defects. Re-priming and/or subsequent patchwork if required shall be performed prior to finish painting at no additional cost.
19. The Painting Contractor is responsible for all sanding and cleaning of surfaces except block and drywall.

Addendum No. 3 Revisions – The following items are to be added to this scope of work:

20. Provide and install all hand-painted signage as identified by specification 101423 Panel Signage.
21. Include in this scope of work a construction allowance of \$15,000 to be utilized as directed by the Construction Manager.

BID CATEGORY BP NO. 7 PAINTING SCOPE OF WORK

BID CATEGORY BP NO. 8 FLOORING AND CERAMIC TILE SCOPE OF WORK

This Scope of Work is to include, but is not limited to, the following Specification Sections:

<u>Section</u>	<u>Description</u>
Division 00	Procurement and Contracting Requirements
Division 01	General Requirements
09 30 00	TILING
09 65 13	RESILIENT BASE AND ACCESSORIES
09 65 19	RESILIENT TILE FLOORING
09 65 66	RESILIENT ATHLETIC FLOORING
09 66 23	RESINOUS MATRIX TERRAZO FLOORING
09 67 23	RESINOUS FLOORING - Delete per Addendum No. 3
09 68 13	CARPETING

This Bid Category Scope of Work describes and assigns Work to this Bid Category as designated by the Construction Manager. Each Contractor shall cooperate and coordinate with all other Bid Category Contractors for proper and expedient completion of the Work in this Project. This summary should in no way be construed as being all inclusive. It is issued as a guide to aid in the assignment of Work and is intended to clarify and/or further define the Scope of Work included in the Bid Documents. They shall not be construed as the entire Scope of Work for this Bid Category. All work described or indicated in the respective Specifications Sections or Divisions listed above shall be included, except as specifically excluded herein.

1. Provide floor and wall floating as required to repair minor substrate defects to insure finish product is plumb and true. Repair work at cracks in concrete slab is included. Include all leveling and patching compounds as recommended and approved by the flooring manufacturer.
2. Final clean all material to remove all grout haze. Clean tile / stone in a manner acceptable to the tile / stone and grout manufacturer's recommendations.
3. Remove and clean-up all debris, packaging, etc. daily. Grout will not be disposed of in any drains.
4. Examine all walls, floors, surfaces and areas to receive tile material prior to starting work and notify contractor in writing of any unsatisfactory condition. Commencement of work shall constitute acceptance of subsurface by this Contractor.
5. Specific care needs to be given when working around other finished surfaces, Contractor shall remove grout immediately.
6. Cuts around fixtures and penetrations shall be neat. Where escutcheons are provided, tile cuts shall be smaller than the escutcheons.
7. Prior to installing floor system, this Contractor will be required to check moisture content of the concrete slabs to be sure they are within the limits.
8. Install and maintain floor protection of finished floors. Contractor shall dispose of paper as directed by Garmong.
9. This Contractor is responsible for broom cleaning prior to installation of the flooring system.
10. It is the flooring Contractor's responsibility to walk the building prior to the scheduled installation of floor covering. Nicks, small holes, cracks, depressions, rough areas, control joints, column diamonds, etc. in floors caused by construction process are expected and are a part of this

Contractor's scope of work to repair with floor patch. Contractor may have to do some minor floor scraping. Contractor shall report any conditions in writing to the contractor that warrant excessive floor patch. Commencement of work without such notice shall constitute acceptance of subsurface by this Contractor. Excessive floor patch is defined as greater than 10% of the floor area per building.

11. Vinyl repairs and minor carpet repairs are inherent in the construction process and are the responsibility of the Contractor to correct.
12. Provide final cleaning of vinyl tile in accordance with the flooring manufacturer's instructions immediately prior to turnover to Owner.
13. Contractor shall caulk joint between flooring and hollow metal frame.

Addendum No. 3 Revisions – The following items are to be added to this scope of work:

14. Delete specification section 096723 Resinous Flooring from this scope of work.
15. Include in this scope of work a construction allowance of \$15,000 to be utilized as directed by the Construction Manager.

BID CATEGORY BP NO. 8 FLOORING AND CERAMIC TILE SITE DEVELOPMENT SCOPE OF WORK

BID CATEGORY BP NO. 9 FIRE PROTECTION SCOPE OF WORK

This Scope of Work is to include, but is not limited to, the following Specification Sections:

<u>Section</u>	<u>Description</u>
Division 00	Procurement and Contracting Requirements
Division 01	General Requirements
07 84 13	PENETRATION FIRESTOPPING
21 05 17	SLEEVES AND SLEEVE SEALS FOR FIRE-SUPPRESSION PIPING
21 05 18	ESCUTCHEONS FOR FIRE-SUPPRESSION PIPING
21 05 23	GENERAL-DUTY VALVES FOR FIRE PROTECTION PIPING
21 05 29	HANGERS AND SUPPORTS FOR FIRE SUPPRESSION PIPING AND EQUIPMENT
21 05 48	VIBRATION & SEISMIC CONTROLS FOR FIRE-SUPPRESSION PIPING AND EQUIPMENT
21 05 53	IDENTIFICATION FOR FIRE-SUPPRESSION PIPING AND EQUIPMENT
21 11 19	FIRE DEPARTMENT CONNECTIONS
21 13 13	WET-PIPE SPRINKLER SYSTEM
21 13 16	DRY-PIPE SPRINKLER SYSTEMS

This Bid Category Scope of Work describes and assigns Work to this Bid Category as designated by the Construction Manager. Each Contractor shall cooperate and coordinate with all other Bid Category Contractors for proper and expedient completion of the Work in this Project. This summary should in no way be construed as being all inclusive. It is issued as a guide to aid in the assignment of Work and is intended to clarify and/or further define the Scope of Work included in the Bid Documents. They shall not be construed as the entire Scope of Work for this Bid Category. All work described or indicated in the respective Specifications Sections or Divisions listed above shall be included, except as specifically excluded herein.

1. Provide fire hydrant flow test and reports.
2. Site fire water piping by others, piping from 1' above finished floor.
3. Contractor is responsible for pulling all trade permits, paying all fees, and scheduling all required inspections associated with this work.
4. Firestopping of sprinkler piping penetrations in rated walls.
5. Through wall pipe penetrations through secure walls will require coordination with the installing Contractor.
6. All sleeves in new masonry walls and precast shall be laid out and provided by this bid package. All required core drilling, should a sleeve be missed, shall be the responsibility of this bid package.
7. Provide all access doors and panels to access concealed items where not shown on Drawings but required by Code. Include all costs for installation by other Bid Package Contractors. (Masonry Contractor, Metal Stud/Drywall Contractor)
8. Provide detention rated fire suppression heads in secure areas. Locate piping such that piping is not accessible to inmates. Provide detention rated pipe enclosures where piping is installed within reach of inmates. Note locations of steel ceilings, soffits, bulkheads, beam wraps, and utility

enclosures. These items are to be utilized for routing of fire suppression piping but will be shared with other utilities.

9. A complete as-built drawing of the Fire Protection system shall be maintained through and turned over at the end of the project.
10. Variations of pipe routing to accommodate building conditions and/or other trades may exist. An above ceiling coordination meeting incorporating all trades with work in the space will be required prior to rough-in.

Addendum No. 2 Revisions – The following items are to be added to this scope of work:

11. Sprinkler heads located inside all prefabricated cells are furnished and installed by this Bid Package. Prefabricated cells will be prepared for sprinkler head installation either in the rear wall or ceiling by Bid Package 13. In addition, all prefabricated cells shall have connection points where this Bid Package will connect the water supply to the cell piping.

Addendum No. 3 Revisions – The following items are to be added to this scope of work:

12. Include in this scope of work a construction allowance of \$10,000 to be utilized as directed by the Construction Manager.

BID CATEGORY BP NO. 9 FIRE PROTECTION SCOPE OF WORK

BID CATEGORY BP NO. 10 MECHANICAL AND PLUMBINGSCOPE OF WORK

This Scope of Work is to include, but is not limited to, the following Specification Sections:

<u>Section</u>	<u>Description</u>
Division 00	Procurement and Contracting Requirements
Division 01	General Requirements
07 84 13	PENETRATION FIRESTOPPING
07 72 13	MANUFACTURED ACCESS CURBS AND COVERS FOR CONVENTIONAL ROOFS – Add per Addendum No. 3
08 91 19	FIXED LOUVERS
11 53 13	LABORATORY FUME HOODS – Add per Addendum No. 3
22 05 13	COMMON MOTOR REQUIREMENTS FOR PLUMBING EQUIPMENT
22 05 16	EXPANSION FITTINGS AND LOOPS FOR PLUMBING PIPING
22 05 17	SLEEVES AND SLEEVE SEALS FOR PLUMBING PIPING
22 05 18	ESCUTCHEONS FOR PLUMBING PIPING
22 05 19	METERS AND GAGES FOR PLUMBING PIPING
22 05 23.12	BALL VALVES FOR PLUMBING PIPING
22 05 23.13	BUTTERFLY VALVES FOR PLUMBING PIPING
22 05 23.14	CHECK VALVES FOR PLUMBING PIPING
22 05 23.15	GATE VALVES FOR PLUMBING PIPING
22 05 29	HANGERS AND SUPPORTS FOR PLUMBING PIPING AND EQUIPMENT
22 05 48.13	VIBRATION CONTROLS FOR PLUMBING PIPING AND EQUIPMENT
22 05 53	IDENTIFICATION FOR PLUMBING PIPING AND EQUIPMENT
22 07 19	PLUMBING PIPING INSULATION
22 11 13	FACILITY WATER DISTRIBUTION PIPING
22 11 16	DOMESTIC WATER PIPING
22 11 19	DOMESTIC WATER PIPING SPECIALTIES
22 11 23.13	DOMESTIC WATER-PACKAGED BOOSTER PUMPS
22 11 23.21	INLINE, DOMESTIC WATER PUMPS
22 13 13	FACILITY SANITARY SEWERS
22 13 16	SANITARY WASTE AND VENT PIPING
22 13 19	SANITARY WASTE PIPING SPECIALTIES
22 13 19.13	SANITARY DRAINS
22 13 23	SANITARY WASTE INTERCEPTORS
22 13 29	SANITARY SEWERAGE PUMPS
22 14 13	FACILITY STORM DRAINAGE PIPING
22 14 23	STORM DRAINAGE PIPING SPECIALTIES
22 14 29	SUMP PUMPS
22 16 13	FACILITY NATURAL GAS PIPING
22 31 00	DOMESTIC WATER SOFTENERS
22 34 00	FUEL-FIRED DOMESTIC WATER HEATERS

22 41 00	RESIDENTIAL PLUMBING FIXTURES
22 42 13.13	COMMERCIAL WATER CLOSETS
22 42 13.16	COMMERCIAL URINALS
22 42 16.13	COMMERCIAL LAVATORIES
22 42 16.16	COMMERCIAL SINKS
22 42 23	COMMERCIAL SHOWERS
22 45 00	EMERGENCY PLUMBING FIXTURES
22 46 00	SECURITY PLUMBING FIXTURES
22 47 16	PRESSURE WATER COOLERS
23 05 13	COMMON MOTOR REQUIREMENTS FOR HVAC EQUIPMENT
23 05 16	EXPANSION FITTINGS AND LOOPS FOR HVAC PIPING
23 05 17	SLEEVES AND SLEEVE SEALS FOR HVAC PIPING
23 05 18	ESCUTCHEONS FOR HVAC PIPING
23 05 19	METERS AND GAGES FOR HVAC PIPING
23 05 23.11	GLOBE VALVES FOR HVAC PIPING – Revised per Addendum No. 3
23 05 23.12	BALL VALVES FOR HVAC PIPING
23 05 23.13	BUTTERFLY VALVES FOR HVAC PIPING
23 05 23.14	CHECK VALVES FOR HVAC PIPING
23 05 23.15	GATE VALVES FOR HVAC PIPING
23 05 23.16	PLUG VALVES FOR HVAC PIPING
23 05 29	HANGERS AND SUPPORTS FOR HVAC PIPING AND EQUIPMENT
23 05 48.13	VIBRATION CONTROLS FOR HVAC PIPING AND EQUIPMENT – Rev per Addendum No.3
23 05 53	IDENTIFICATION FOR HVAC PIPING AND EQUIPMENT
23 05 93	TESTING, ADJUSTING, AND BALANCING FOR HVAC
23 07 13	DUCT INSULATION
23 07 16	HVAC EQUIPMENT INSULATION
23 07 19	HVAC PIPING INSULATION
23 09 23	DIRECT DIGITAL CONTROL (DDC) SYSTEM FOR HVAC
23 09 24	REFRIGERANT DETECTION AND ALARM
23 21 13	HYDRONIC PIPING
23 21 16	HYDRONIC PIPING SPECIALTIES
23 21 23	HYDRONIC PUMPS
23 23 00	REFRIGERANT PIPING
23 25 13	WATER TREATMENT FOR CLOSED-LOOP HYDRONIC SYSTEMS
23 31 13	METAL DUCTS
23 33 00	AIR DUCT ACCESSORIES
23 33 46	FLEXIBLE DUCTS
23 34 23	HVAC POWER VENTILATORS
23 34 33.13	COMMERCIAL AIR CURTAINS
23 36 00	AIR TERMINAL UNITS
23 37 13.13	AIR DIFFUSERS
23 37 13.23	REGISTERS AND GRILLES
23 37 13.14	SECURITY REGISTERS AND GRILLES
23 37 23	HVAC GRAVITY VENTILATORS

23 51 23	GAS VENTS
23 52 16	CONDENSING BOILERS
23 55 23.13	LOW-INTENSITY, GAS-FIRED, RADIANT HEATERS
23 64 26.13	AIR-COOLED, ROTARY-SCREW WATER CHILLERS
23 73 13.13	INDOOR, BASIC AIR-HANDLING UNITS
23 74 16.11	PACKAGED, SMALL-CAPACITY, ROOFTOP AIR-CONDITIONING UNITS
23 74 33	DEDICATED OUTDOOR-AIR UNITS
23 81 23.13	COMPUTER-ROOM AIR-CONDITIONERS, CEILING MOUNTED UNITS
23 81 26	SPLIT-SYSTEM AIR CONDITIONERS
23 82 13	VALANCE HEATING AND COOLING UNITS
23 82 19	FAN COIL UNITS
23 82 39.16	PROPELLER UNIT HEATERS
23 82 39.19	WALL AND CEILING UNIT HEATERS
33 32 45	HORIZONTAL SHAFT COMMUNITER – added per Addendum No. 2

This Bid Category Scope of Work describes and assigns Work to this Bid Category as designated by the Construction Manager. Each Contractor shall cooperate and coordinate with all other Bid Category Contractors for proper and expedient completion of the Work in this Project. This summary should in no way be construed as being all inclusive. It is issued as a guide to aid in the assignment of Work and is intended to clarify and/or further define the Scope of Work included in the Bid Documents. They shall not be construed as the entire Scope of Work for this Bid Category. All work described or indicated in the respective Specifications Sections or Divisions listed above shall be included, except as specifically excluded herein.

1. All items within this package are to be furnished and installed unless otherwise noted.
2. All material handling, rigging, unloading, staging, and storage of all materials.
3. Contractor is responsible for obtaining all trade permits, paying all fees and scheduling and attending all required inspections associated with this work.
4. Temporary HVAC per requirements of 01 51 23 – Temporary HVAC
5. Temporary water per requirements of 01 51 36 – Temporary Water
6. Provide all site underground sanitary piping and structures; domestic and fire water piping and vault; and gas piping from utility. Fire water piping shall be capped at 1' above finished floor.
7. All housekeeping pads.
8. All excavation, backfill, concrete, masonry, and concrete patching required to complete this scope of work.
9. Through wall penetrations through secure masonry walls will require coordination with the Masonry Bid Package. Layout and coordination between all other Bid Packages is required.
10. Any roof penetrations shall be coordinated with the Roofing Contractor. Provide all accessories for roof and slab penetrations including sleeves and roofing accessories.
11. All sleeves in new masonry walls and precast shall be laid out and provided by the bid package. Coordinate installation of sleeves with the Masonry Contractor. Cutting and patching of precast planks for this scope shall be by this contractor.
12. Variations of piping and duct routing to accommodate building conditions and/or other trades may exist. An above ceiling coordination meeting will be required prior to rough-in.

13. Provide all access doors and panels necessary to access concealed HVAC and plumbing accessories where required by Code but not shown on Drawings. Access doors and panels in secure areas are to be detention rated. Access doors and panels in rated walls and ceilings need to be fire rated. Include cost on installation by other Bid Packages (Masonry Contractor and Metal Stud Drywall Contractor)
14. All refrigerant piping for new HVAC equipment, excluding freezer/cooler work.
15. Provide all man bars at duct penetrations through security walls. Man bars shall be provided at all locations where ductwork penetrates walls within the security perimeter. Provide miscellaneous angles and support members as indicated. Where man bars of fire dampers are identified or required at the same location, provide UL rated out of wall style dampers. Provide retaining angles for mounting security grilles in metal ceilings, soffits, bulkheads, and utility enclosures and do not weld security GRD's to the face of these items.
16. Coordinate BAS network connections and interface with smoke control system with Electrical Contractor.
17. A certified lifting plan shall be presented to Garmong Construction general superintendent prior to any equipment lifts associated with this bid package.
18. Sheetmetal ductwork connections to detention cells may be either round or rectangular. Include provisions for either type.
19. Provide General Trades Contractor with templates to be used in cutting countertops. Coordinate rough-in information with various trades.
20. This Contractor is responsible for furnishing any temporary valves, pumps gauges etc. to complete the work as required and scheduled.
21. *Addendum No. 2* Revision: All plumbing fixtures located inside prefabricated steel cells, shall be furnished and installed by Bid Package No. 13. All other plumbing fixtures shall be provided and installed by this Bid Package.

Addendum No. 2 Revisions – The following items are to be added to this scope of work:

22. Add to this scope of work Specification Section 333245 Horizontal Shaft Communiter. Provide and install the Communiter along with all concrete pads and accessories for a complete and operational system. Line voltage power will be provided by others; all other work by this bid package.
23. Revised Note 21 to clarify plumbing fixture responsibility

Addendum No. 3 Revisions – The following items are to be added to this scope of work:

24. Add to this scope of work Specification Section 077213 Manufactured Access Curbs and Covers for Conventional Roofs.
25. Provide and install all roof curbs required for the items installed under this scope of work.
26. The kitchen hood and dishwasher hood are furnished by Bid Package No. 12 for installation by Bid Package No. 10. Coordinate all work with the Kitchen Equipment Contractor.
27. All work associated with the off-site sanitary sewer installation shall be the responsibility of this bid package. This shall include, but not limited to, all layout, demolition, excavation, installation, backfill, piping, cutting, road paving, remediation and landscaping. All areas will be restored to a finished condition.

28. Incorporate specification revisions issued in Addendum No. 2 & No. 3
29. Provide and install all laboratory fume hoods for a complete and operational system.
30. Include in this scope of work a construction allowance of \$100,000 to be utilized as directed by the Construction Manager.
31. Provide a voluntary alternate to revise all underground cast iron piping to be PVC in lieu of cast iron.

BID CATEGORY BP NO. 10 MECHANICAL AND PLUMBING MECHANICAL SCOPE OF WORK

BID CATEGORY BP NO. 11 ELECTRICAL SYSTEM SCOPE OF WORK

This Scope of Work is to include, but is not limited to, the following Specification Sections:

<u>Section</u>	<u>Description</u>
Division 00	Procurement and Contracting Requirements
Division 01	General Requirements
07 84 13	PENETRATION FIRESTOPPING
26 05 19	LOW VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES
26 05 26	GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS
26 05 29	HANGERS AND SUPPORTS FOR ELECTRICAL SYSTEMS
26 05 33	RACEWAY AND BOXES FOR ELECTRICAL SYSTEMS
26 05 44	SLEEVES AND SLEEVE SEALS FOR ELECTRICAL RACEWAYS AND CABLING
26 05 48.16	SEISMIC CONTROLS FOR ELECTRICAL SYSTEMS
26 05 53	IDENTIFICATION FOR ELECTRICAL SYSTEMS
26 05 73.13	SHORT-CIRCUIT STUDIES
26 05 73.16	COORDINATION STUDIES
26 05 73.19	ARC-FLASH HAZARD ANALYSIS
26 09 23	LIGHTING CONTROL DEVICES
26 22 13	LOW-VOLTAGE DISTRIBUTION TRANSFORMERS
26 23 13	PARALLELING LOW-VOLTAGE SWITCHGEAR
26 24 13	SWITCHBOARDS
26 24 16	PANELBOARDS
26 25 00	ENCLOSED BUS ASSEMBLIES
26 27 26	WIRING DEVICES
26 28 13	FUSES
26 28 16	ENCLOSED SWITCHES AND CIRCUIT BREAKERS
26 29 13.03	MANUAL AND MAGNETIC MOTOR CONTROLLERS
26 29 23	VARIABLE FREQUENCY MOTOR CONTROLLERS
26 32 13	DIESEL ENGINE GENERATORS
26 32 14	STATIONARY LOAD BANK WITH LOAD LEVELING CONTROL – added per Add No.3
26 33 53	STATIC UNINTERRUPTIBLE POWER SUPPLY
26 36 00	TRANSFER SWITCHES
26 43 13	SURGE PROTECTION FOR LOW-VOLTAGE ELECTRICAL POWER CIRCUITS
26 51 19	LED INTERIOR LIGHTING
26 56 13	LIGHTING POLES AND STANDARDS
26 56 19	LED EXTERIOR LIGHTING
27 05 26	GROUNDING AND BONDING FOR COMMUNICATIONS SYSTEMS
27 05 28	PATHWAYS FOR COMMUNICATIONS SYSTEMS
27 05 29	HANGERS AND SUPPORTS FOR COMMUNICATIONS SYSTEMS
27 05 36	CABLE TRAYS FOR COMMUNICATIONS SYSTEMS
27 05 44	SLEEVES AND SLEEVE SEALS FOR COMMUNICATIONS PATHWAYS AND CABLING
27 05 48.16	SEISMIC CONTROLS FOR COMMUNICATIONS SYSTEMS

27 05 53	IDENTIFICATION FOR COMMUNICATIONS SYSTEMS
27 11 00	COMMUNICATIONS EQUIPMENT ROOM FITTINGS
27 11 16	COMMUNICATIONS RACKS, FRAMES, AND ENCLOSURES
27 13 00	COMMUNICATIONS BACKBONE CABLING – added per Addendum No. 2
27 13 13	COMMUNICATIONS COPPER BACKBONE CABLING delete per add. No. 2
27 13 23	COMMUNICATIONS OPTICAL FIBER BACKBONE CABLING
27 13 33	COMMUNICATIONS COAXIAL BACKBONE CABLING delete per add. No. 2
27 15 00	COMMUNICATIONS HORIZONTAL CABLING Added per Addendum No. 2
27 15 13	COMMUNICATIONS COPPER HORIZONTAL CABLING delete per add. No. 2
27 15 33	COMMUNICATIONS COAXIAL HORIZONTAL CABLING delete per add. No. 2
27 41 33	MASTER ANTENNA TELEVISION SYSTEM
28 05 00	COMMON WORK RESULTS FOR ELECTRONIC SAFETY AND SECURITY
28 05 10	CABINETS AND ENCLOSURES
28 46 19	SECURITY AUTOMATION SYSTEM
28 46 20	VIDEO GRAPHIC USE INTERFACE
28 46 21.11	ADDRESSABLE FIRE-ALARM SYSTEMS
28 51 23	AUDIO COMMUNICATIONS SYSTEMS

This Bid Category Scope of Work describes and assigns Work to this Bid Category as designated by the Construction Manager. Each Contractor shall cooperate and coordinate with all other Bid Category Contractors for proper and expedient completion of the Work in this Project. This summary should in no way be construed as being all inclusive. It is issued as a guide to aid in the assignment of Work and is intended to clarify and/or further define the Scope of Work included in the Bid Documents. They shall not be construed as the entire Scope of Work for this Bid Category. All work described or indicated in the respective Specifications Sections or Divisions listed above shall be included, except as specifically excluded herein.

1. All items within this package are to be furnished and installed unless otherwise noted.
2. Contractor is responsible for obtaining all trade permits, paying all fees and scheduling and attending all required inspections associated with this work. This includes preparing and submitting all fire alarm drawings to state and local permitting and plan review authorities in a timely manner so as not to delay the start of work.
3. Temporary power and lighting as specified in 01 15 13 – Temporary Electricity.
4. Light pole bases.
5. All housekeeping and transformer pads.
6. Provide underground conduit rough-in for site primary feed from utility source to utility service provided primary transformer. Provide the CT metering cabinet and install the utility furnished meter socket. Coordinate with the utility provider, submit all applications and pay all required fees.
7. All underground conduit rough-in for telephone and fiber to utility service.
8. All excavation, backfill, concrete, masonry and concrete patching required to complete this scope of work.
9. Schedule of any required shutdowns shall be coordinated with Garmong.
10. All material handling, rigging, unloading, staging, and storage of all materials.

11. Through wall penetrations through secure masonry walls will require close coordination with the Masonry Bid Package. Layout and coordination between other Bid Packages is required.
12. Install all electrified door, overhead door, and coiling shutter hardware components furnished by General Trades Contractor and provide wiring terminations. This excludes electrified door controls provided by the Detention Equipment Contractor.
13. Any roof penetrations shall be coordinated with the Roofing Contractor. This package shall create the roof penetration to the acceptance of the Roofing Contractor. Provide all accessories for roof and slab penetrations including sleeves and roofing accessories.
14. All sleeves in new masonry walls and precast shall be laid out and provided by this bid package. Coordinate installation of sleeves with Masonry Contractor. Cutting and coring of precast planks for this scope of work shall be by this contractor.
15. Provide all access panels required to access conceal items as required for Code but not shown on Drawings. Include costs for installation by other Bid Packages. (Masonry Contractor and Metal Stud Contractor)
16. It shall be the responsibility of this bid package to provide start up assistance on equipment provided. The equipment manufacturer (when required) shall provide start up on all equipment.
17. All interconnecting wiring and devices as required for new kitchen equipment and kitchen fire protection as described in contract documents.
18. Variations of conduit routing to accommodate existing building conditions and/or other trades may exist. An above ceiling coordination meeting will be required prior to rough-in.
19. Provide and install all components of the telephone, data, communication and coaxial systems for complete an operational systems.
20. Provide all cable support systems, raceways, conduits, wall sleeves, rough-in boxes and cable trays for all low voltage systems installed by as part of this scope of work and for systems installed by others including data and communications, security electronics, electrified door hardware, kitchen and laundry equipment, and fire alarm. This is to exclude *temperature* (Revised per Addendum No. 3) controls /BAS systems which will be provided by the Mechanical & Plumbing Contractor except where specifically indicated on the Contract Documents. Cable trays not identified on the Drawings will be the responsibility of the contractor requiring the cable trays. Install only special back boxes, racks and cabinets furnished by the Detention Equipment Contractor. Layout and provide wall sleeves for these systems as necessary to provide complete raceways.
21. Provide all security electronics cabling, wire, and fiber optic complete and ready for termination at head end racks by the Detention Equipment Contractor. Install only all field devices and lock pigtails and wiring harnesses for security electronics systems. Terminations at head end equipment will be provided by the Detention Equipment Contractor, however, the Electrical Contractor will be responsible for receiving and installing head end equipment racks. Examples of field devices that are furnished by the Detention Equipment Contractor for installation by this contractor include intercoms, cameras, duress devices, watch tower devices, speakers, talk-thru devices, card readers, motion detectors, request to exit buttons, microphones, etc. Note locations where utility control is provided through the security electronics systems and lighting and power is fed through the utility control panels on the security electronics system. Central control computers and monitors are to be furnished and installed by the Detention Equipment Contractor.
22. All BAS and HVAC controls will be the responsibility of the Mechanical & Plumbing Contractor. The Mechanical & Plumbing Contractor will be responsible for furnishing all BAS equipment and

controllers. The Electrical Contractor is responsible for line voltage power connections, relays, VFD terminations, fire alarm connections, power shut down (contactors), motor starters, or disconnects associated with the controls system, all of which are to be furnished and/or installed as detailed in this scope of work.

Addendum No. 2 Revisions – The following items are to be added to this scope of work:

23. Add Specification Section 263214 Stationary Load Bank with Load Leveling Control to this scope of work.
24. Add Specification Section 271300 Communications Backbone Cabling to this scope of work.
25. Add Specification Section 271500 Communications Horizontal Cabling to this scope of work.
26. Delete Specification Section 271313 Communications Copper Backbone Cabling from this scope of work.
27. Delete Specification Section 271333 Communications Coaxial Backbone Cabling from this scope of work.
28. Delete Specification Section 271533 Communications Coaxial Horizontal Cabling from this scope of work.

Addendum No. 3 Revisions – The following items are to be added to this scope of work:

29. Bid Package 11, item 20, second sentence, delete the word temporary and replace with temperature
30. Provide all conduit and boxes to the General Trades package along with associated layout for installation in all precast concrete.
31. Specification Section 28 4621.11 ADDRESSABLE FIRE-ALARM SYSTEMS is to be provide and installed by Bid Package No. 11. Coordinate this work with Bid Package No. 13 for integration of security system components.
32. In specification section 280500 Common Work Results for Electronic Safety and Security, this bid package shall provide and install all work defined as being performed by the "Division 26 Contractor".
33. Include in this scope of work a construction allowance of \$100,000 to be utilized as directed by the Construction Manager.

BID CATEGORY BP NO. 11 ELECTRICAL SYSTEM SCOPE OF WORK

BID CATEGORY BP NO. 12 KITCHEN EQUIPMENT SCOPE OF WORK

This Scope of Work is to include, but is not limited to, the following Specification Sections:

<u>Section</u>	<u>Description</u>
Division 00	Procurement and Contracting Requirements
Division 01	General Requirements
07 72 13	MANUFACTURED ACCESS CURBS AND COVERS FOR CONVENTIONAL ROOFS – Add per Addendum No. 3
07 92 00	Joint Sealants
07 84 13	Penetration Firestopping
11 40 00	Food Service Equipment

This Bid Category Scope of Work describes and assigns Work to this Bid Category as designated by the Construction Manager. Each Contractor shall cooperate and coordinate with all other Bid Category Contractors for proper and expedient completion of the Work in this Project. This summary should in no way be construed as being all inclusive. It is issued as a guide to aid in the assignment of Work and is intended to clarify and/or further define the Scope of Work included in the Bid Documents. They shall not be construed as the entire Scope of Work for this Bid Category. All work described or indicated in the respective Specifications Sections or Divisions listed above shall be included, except as specifically excluded herein.

1. Provide coordination with mechanical and electrical contractors for connections to equipment. This contractor will be responsible for all interconnect wiring and controls wiring required for a complete operational system acceptable to owner, AE, and Construction Manager. Utility connections will be provided by others to the extent indicated on the plumbing, mechanical, and electrical drawings. This contractor will be required to coordinate utility connections with these drawings from the construction set and will bear any costs associated with modifications to these requirements as a result of not matching these drawings.
2. This contractor will be responsible for installation of refrigeration line sets and condensate drains associated with the cooler/freezer including roof curbs, equipment supports and penetrations.
3. Provide all anchor bolts, seismic restraints and anchoring of equipment. Where anchors are to be embedded in masonry or concrete, furnish only to the Masonry or General Trades contractors prior to installation of masonry or concrete. Not furnishing these items prior to the installation of these systems will require post installation by this contractor.
4. Furnish all light fixtures integral to items installed by this scope of work, installation of light fixtures by Electrical contractor.
5. Provide sealants as specified to seal abutting surfaces that produce airtight, watertight and sanitary joints.
6. Provide cardboard protection for all stainless-steel surfaces during construction, remove before final cleaning.
7. Provide the insulated floor system at the walk-in cooler/freezer.

8. Furnish only kitchen hood and dishwasher hood for installation by the Mechanical contractor. Furnish all closure pieces and trim necessary for a complete installation.
9. Provide hood fire suppression system. Furnish only gas shut off valve for installation by the plumbing contractor. Provide contactor/hood control panel to allow for interface to the fire alarm system (connection by others), BAS (connection by others), and shut down of electrical power to kitchen equipment where indicated. Provide kitchen temperature sensor for wire connections by others.
10. Provide all required plan review, permits and fees associated with work of this category, specifically coordination with the authorities having jurisdiction and health department.
11. Provide field start-up of all equipment furnished or installed under this scope of work.
12. This contractor shall be responsible for notifying CM prior the start of above grade masonry if there are any pieces of equipment that are not capable of fitting through planned door openings.

Addendum No. 3 Revisions – The following items are to be added to this scope of work:

13. Add to this scope of work Specification Section 077213 Manufactured Access Curbs and Covers for Conventional Roofs.
14. Provide and install all roof curbs required for the items installed under this scope of work.
15. Include in this scope of work a construction allowance of \$10,000 to be utilized as directed by the Construction Manager.

BID CATEGORY BP NO. 12 KITCHEN EQUIPMENT SCOPE OF WORK

BID CATEGORY BP NO. 13 DETENTION EQUIPMENT SCOPE OF WORK

This Scope of Work is to include, but is not limited to, the following Specification Sections:

<u>Section</u>	<u>Description</u>
Division 00	Procurement and Contracting Requirements
Division 01	General Requirements
05 05 53	SECURITY METAL FASTENINGS
08 31 19	SECURITY ACCESS DOORS AND FRAMES
08 34 63	DETENTION DOORS AND FRAMES
08 56 63	DETENTION WINDOWS AND SKYLIGHTS
08 71 63	DETENTION DOOR HARDWARE
08 71 63A	DETENTION DOOR HARDWARE SETS
08 88 53	SECURITY GLAZING
09 57 53	SECURITY CEILING ASSEMBLIES
09 78 63	SAFETY PADDING
10 2813.63	DETENTION TOILET ACCESSORIES
11 17 36	PACKAGE TRANSFER UNITS – Added per Addendum No. 3
11 18 00	SECURITY EQUIPMENT
11 19 00	DETENTION EQUIPMENT CONTRACTOR
11 19 03	SECURITY SCREEN-WOVEN ROD
11 19 16	DETENTION GUN LOCKERS – Added per Addendum No. 3
11 29 23	INMATE PROPERTY PACKAGING EQUIPMENT – Added per Addendum No.3
12 52 83	FIXED BEAM SEATING – Added per Addendum No. 3
12 55 00	DETENTION FURNITURE
12 56 00	INSTITUTIONAL FURNITURE
13 55 00	PREFABRICATED MODULAR STEEL CELLS
28 05 00	COMMON WORK RESULTS FOR ELECTRONIC SAFETY AND SECURITY
28 05 10	CABINETS AND ENCLOSURES
28 13 00	ACCESS CONTROL SYSTEM – Added per Addendum No. 2
28 23 00	IP VIDEO COMMUNICATION SYSTEM– Added per Addendum No. 2
28 46 19	SECURITY AUTOMATION SYSTEM
28 46 20	VIDEO GRAPHIC USE INTERFACE
28 4621.11	ADDRESSABLE FIRE-ALARM SYSTEMS
28 51 23	AUDIO COMMUNICATIONS SYSTEMS

This Bid Category Scope of Work describes and assigns Work to this Bid Category as designated by the Construction Manager. Each Contractor shall cooperate and coordinate with all other Bid Category Contractors for proper and expedient completion of the Work in this Project. This summary should in no way be construed as being all inclusive. It is issued as a guide to aid in the assignment of Work and is intended to clarify and/or further define the Scope of Work included in the Bid Documents. They shall not be construed as the entire Scope of Work for this Bid Category. All work described or indicated in

the respective Specifications Sections or Divisions listed above shall be included, except as specifically excluded herein.

1. Furnish only all interior and exterior detention hollow metal door and window frames, security access panel frames, chase doors frames, and tear gas ports to be installed by General Trades Contractor. Provide on-site training and supervision during initial installation.
2. *Addendum No. 2:* Furnish and install all detention and institutional furnishings
3. Frames to be furnished prior to the start of above slab masonry walls. Provide guarantee letter from manufacturers agreeing to this date and allow 4 weeks for submittal review. Frames that cannot be factory prepped for hardware in time to make these delivery dates shall be prepped in the field by this contractor. This Contractor is responsible for furnishing steel plate embeds at all locations where frames are not delivered in time for masonry wall construction and will be responsible for field installation of frames as part of this scope of work. If frames are delivered on time, plate embeds can be omitted.
4. Careful coordination will be required with the Security Electronics Contractor to prep frames to receive frame mounted security electronics devices such as intercoms, DPS devices, locks, push buttons, request to exit devices and all electrified hardware components. Junction boxes, conduit raceways, enclosures, and access plates for all items shall come factory installed.
5. Door, window, and access panel openings in rated wall or ceiling assemblies are to be rated regardless of whether correctly indicated on the door schedule.
6. This contractor will be responsible for furnishing frame anchor straps/masonry anchors to be installed by others.
7. *Addendum No. 2:* This contractor will be responsible for furnishing for installation by Bid Package 1, all plate steel frame closure pieces between frames and to close off gaps around frames and columns between frames. Closure pieces are to be field measured by this contractor.
8. Provide all conduit runs, junction boxes, enclosures, and access plates factory installed in detention doors and frames. At frames where access to junction boxes will be inaccessible, provide conduit runs through frame to either top or bottom of frame to be coordinated with the Electrical Contractor. Frame mounted conduit and junction boxes are to be factory sealed to avoid leaks during grouting of frames.
9. Furnish all detention hollow metal doors complete. This contractor will be responsible for storing doors until installed. On site storage will be permitted, however, this contractor will be responsible for receiving, unloading, and protecting until installed.
10. All openings as part of this scope of work in rated wall or ceiling assemblies are to be rated regardless of whether correctly indicated on the door schedule. Refer to fire rated assembly plans. Rated openings are to be complete rated assemblies (door, frame, glass, hardware) and shall bear UL label.
11. Coordinate with the Electrical Contractor to prep doors to receive hardware and security electronics devices such as concealed closures, DPS devices, locks, etc.
12. Provide all detention door hardware complete in detention openings provided under this scope of work as well as all detention hardware in non-detention openings.
13. Furnish only all pigtails and wire harnesses for all locks and electrified door hardware to be installed by the Electrical Contractor. Provide final adjustment and installation of cover plates and trim after

- installation of security electronics wiring at all door locations. Door mutes are to be field installed AFTER finish painting of doors and frames by this contractor.
14. Include all weather stripping, gaskets, sweeps, thresholds, etc at doors installed under this work category. Food pass and cuff port openings and shutters are to be factory installed in door openings provided by this contractor.
 15. Provide all keying and key controls for locks installed by this work category. Attend keying coordination meetings in person.
 16. Provide final adjustment of all detention doors after HVAC system is fully functional and building final enclosure including adjustment of hinges, closers, DPS, and LSS devices.
 17. Provide all security glazing complete including security glazing in openings, non-detention doors and frames where indicated furnished and/or installed by the work of this category. Fire rated glazing is to be permanently etched with UL rating. Glazing is to fit tightly to frame and/or glazing stops without any gaps and with glazing tape or sealants cut below edge of glazing stops. Any gaps at these locations will be addressed by this contractor or will receive security joint sealants by others paid for by this contractor.
 18. Provide all detention toilet and bath accessories, equipment, and furnishings complete. This includes but is not limited to all toilet paper holders (furnish only where embedded in masonry), security grab bars, security robe hooks, security shelves, security mirrors, security hook strips, security desks, stools, bunks, report writing shelves, dayroom tables, pistol lockers, key cabinets, package passes, sill passes, kitchen tool lockers, security tables, wall mounted swing stools, benches, security shower curtains, etc.
 19. Provide detailed coordination drawings and furnish only all steel embeds for detention furnishings and accessories to Masonry Contractor. Embeds are to be delivered to the Masonry Contractor prior to the start of above grade masonry. Provide touchup of all factory primers, paints and finishes after installation to prepare for finish coat so that welding burns do not telegraph through finish paint. Finish coats to be provided by Painting Contractor. Remove all welding burns and slag from adjacent surfaces.
 20. Provide all woven mesh security barriers. Coordinate sizes and location requirements for embedded anchors in precast and steel anchor structure above.
 21. Provide complete and tested touchscreen control system including touchscreen stations, control panels, interface boards and PLCs with complete and operational function of the door control system, CCTV system, alarms, utility controls, and audio control systems, etc. accepted by Owner, A/E, and Construction Manager.
 22. Provide complete and tested door control system including all interface board, relay cabinets, install only pig tails and wire harnesses at new detention locks, and system functionality indicated, specified, or required.
 23. Provide complete and tested intercom and paging system including all PLC, software, programming, power supplies, amplifiers, microphones, intercom devices, speakers, intercom stations, interface boards and all other equipment indicated or required to achieve system functionality.
 24. Provide complete and tested CCTV system including all cameras and mounting hardware, network video recorders, matrix switch input cards, DVRs capable of maintaining the specified level of storage, and camera power supplies as well as all other equipment indicated or required to achieve system functionality.

25. Furnish only all field devices, racks, relays, controllers, equipment, etc. factory assembled and tested to the furthest extent possible for field installation by the Electrical Contractor. Provide on-site training, assistance, and verification a minimum of once a month prior to the start of on-site start-up and testing.
26. Provide onsite start-up and testing of all devices and systems provided as part of this scope of work.
27. Provide all control panels and consoles required to achieve a complete functional system.
28. Provide detailed point to point wiring diagrams with required back box and conduit sizing and groupings for all new and existing devices. Cabling, conduit, raceways, back boxes (except specialty back boxes indicated to be provided as part of this scope of work) required to complete this scope of work will be provided by the Electrical Contractor.
29. Furnish only all specialty back-boxes to the Electrical Contractor for installation.
30. Provide up to (4) 8-hour training sessions for general operation of the security electronics system in addition to separate maintenance and supervisor level training to accommodate continued operation of facility.
31. Develop and provide a quality assurance plan demonstrating that every aspect of the detention equipment and security electronics system by the DSC and ESS shall function properly at substantial completion. Include in that plan a detention lock and detention door commissioning plan cycling every door and lock from fully closed to fully open twenty (20) times before substantial completion. Document this effort for every door as witnessed by an independent commissioning agent engaged by the CM.
32. This contractor will be responsible of providing all services identified throughout the drawings and specifications of those parties identified as the Detention Systems Contractor (DSC), Electronics System Contractor (ESS), Electronic Security Systems Contractor (ESSS), Detention Hardware Contractor (DEC), Detention Electronics Contractor (DEC), Detention Hardware Sub-Contractor(DESC), Touchscreen Control System Vendor (TCSV) and Security Contractor Installer (SCI). Where scope delineation conflicts exist between this Scope of Work and any other section of the specifications or construction drawings, this Scope of Work shall govern.

Addendum No. 2 Revisions – The following items are to be added to this scope of work:

33. Add Specification Section 281300 Access Control System to this scope of work
34. Add Specification Section 282300 IP Video Communication System to this scope of work
35. All stairs, handrails, guardrails, grating, mezzanine steel, etc. located in the Day Rooms shall be furnished and installed by Bid Package No. 13.
36. All plumbing fixtures located inside prefabricated steel cells, shall be furnished and installed by Bid Package No. 13. All other plumbing fixtures shall be provided and installed by Bid Package 10.
37. Item No. 2 has been amended to furnish and install all detention and institutional furniture.
38. Item No. 7 has been amended to furnish splice plates for installation by Bid Package No. 1.

Addendum No. 3 Revisions – The following items are to be added to this scope of work:

39. Specification Section 28 4621.11 ADDRESSABLE FIRE-ALARM SYSTEMS has been included in this scope for coordination purposes. All fire alarm system components are to be provide and installed by Bid Package No. 11.

40. In specification section 280500 Common Work Results for Electronic Safety and Security, this bid package shall provide and install all work defined as being performed by the "Division 11 and Division 28 Contractor".
41. Specification Section 111736 Package Transfer Unit has been added to this scope of work. Provide and install all work associated with this specification.
42. Specification Section 111916 Detention Gun Lockers has been added to this scope of work. Provide and install all work associated with this specification
43. Specification Section 112923 Inmate Property Packaging Equipment has been added to this scope of work. Provide and install all work associated with this specification.
44. Specification Section 125283 Fixed Beam Seating has been added to this scope of work. Provide and install all work associated with this specification.
45. Include in this scope of work a construction allowance of \$100,000 to be utilized as directed by the Construction Manager.

BID CATEGORY BP NO. 13 DETENTION EQUIPMENT SCOPE OF WORK

SECTION 013310 - CADD INFORMATION REQUEST FORM

1. Company Information:

Name: _____

Address: _____

Telephone: _____

Contact: _____

Email: _____

2. Drawings Requested:

Job Name: Vigo County Security Center
Terre Haute, Indiana

DLZ #: 1663-1190-90

Drawings: _____

3. Delivery Method: Email

4. Operating System: Windows

5. Drawing Program: AutoCAD Release: _____

6. Preferred Format: ☐ DWG ☐ DXF ☐ Other _____7. Cost/Charges: _____ drawings at **\$100.00** per electronic drawing sheet

= \$ _____

AGREED AND ACCEPTED

Authorized Signature_____
Date

If this information is acceptable, please sign and return with check and Indemnification Clause attached to:

DLZ

Attn: Eric B. Ratts, AIA
157 East Maryland Street
Indianapolis, Indiana 46204

Please make checks payable to:

DLZ

Notation: Project # 1663-1190-90

DISCLAIMER FOR USE OF CONTRACT DOCUMENT CADD

_____, hereafter referred to as the Requesting Company, does hereby acknowledge that DLZ has been requested to deliver to them CADD file(s) for the following items: to be used by the Requesting Company, solely for the purpose of the coordination and expediting of the work for the Vigo County Security Center Job # 1663-1190-90, and for no other purpose. Except for the preceding purpose, the Requesting Company shall make no alterations whatsoever to said CADD file(s) without the written consent and at the direction of DLZ.

DLZ makes no warranty, either expressed or implied, as to the quality or content of the information contained in said CADD file(s) except as herein stated, and further DLZ makes no warranty expressed or implied for the use of CADD file(s) by the Requesting Company for any purpose other than that specifically instructed as intended use for same. Further, said CADD file(s) shall not be assigned to any party other than the Requesting Company.

ACKNOWLEDGED AND ACCEPTED:

Contractor's Name

Contractor's Address

Name Printed

Contractor's City, State, and Zip Code

Signature

Contractor's Telephone Number

Date

Contractor's Email

END OF SECTION 013310

SECTION 033000 - CAST-IN-PLACE CONCRETE

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:

- 1. Cast-in-place concrete, including concrete materials, mixture design, placement procedures, and finishes.

- B. Related Requirements:

- 1. Section 031000 "Concrete Forming and Accessories" for form-facing materials, form liners, insulating concrete forms, and waterstops.
 - 2. Section 032000 "Concrete Reinforcing" for steel reinforcing bars and welded-wire reinforcement.
 - 3. Section 312000 "Earth Moving" for drainage fill under slabs-on-ground.
 - 4. Section 321313 "Concrete Paving" for concrete pavement and walks.

1.3 DEFINITIONS

- A. Cementitious Materials: Portland cement alone or in combination with one or more of the following: blended hydraulic cement, fly ash, slag cement, other pozzolans, and silica fume; materials subject to compliance with requirements.
- B. Water/Cement Ratio (w/cm): The ratio by weight of water to cementitious materials.

1.4 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site.

1.5 ACTION SUBMITTALS

- A. Product Data: for each type of product.
- B. Design Mixtures: For each concrete mixture. Submit alternate design mixtures when characteristics of materials, Project conditions, weather, test results, or other circumstances warrant adjustments.

C. Shop Drawings:

1. Steel Reinforcement Shop Drawings: Placing Drawings that detail fabrication, bending, and placement. Include bar sizes, lengths, material, grade, bar schedules, stirrup spacing, bent bar diagrams, bar arrangement, splices and laps, mechanical connections, tie spacing, hoop spacing, and supports for concrete reinforcement.
2. Construction Joint Layout: Indicate proposed construction joints required to construct the structure.
 - a. Location of construction joints is subject to approval of the Architect.

1.6 INFORMATIONAL SUBMITTALS

A. Qualification Data: For the following:

1. Installer: Include copies of applicable ACI certificates.
 2. Ready-mixed concrete manufacturer.
 3. Testing agency: Include copies of applicable ACI certificates.
- B. Floor surface flatness and levelness measurements report, indicating compliance with specified tolerances.
- C. Preconstruction Test Reports: For each mix design.
- D. Field quality-control reports.
- E. Minutes of preinstallation conference.

1.7 QUALITY ASSURANCE

- A. Installer Qualifications: A qualified installer who employs Project personnel qualified as an ACI-certified Flatwork Technician and Finisher and a supervisor who is a certified ACI Flatwork Concrete Finisher/Technician or an ACI Concrete Flatwork Technician with experience installing and finishing concrete.
1. Post-Installed Concrete Anchors Installers: ACI-certified Adhesive Anchor Installer.
- B. Ready-Mixed Concrete Manufacturer Qualifications: A firm experienced in manufacturing ready-mixed concrete products and that complies with ASTM C94/C94M requirements for production facilities and equipment.
1. Manufacturer certified in accordance with NRMCA's "Certification of Ready Mixed Concrete Production Facilities."
- C. Laboratory Testing Agency Qualifications: A testing agency qualified in accordance with ASTM C1077 and ASTM E329 for testing indicated and employing an ACI-certified Concrete Quality Control Technical Manager.

1. Personnel performing laboratory tests shall be an ACI-certified Concrete Strength Testing Technician and Concrete Laboratory Testing Technician, Grade I. Testing agency laboratory supervisor shall be an ACI-certified Concrete Laboratory Testing Technician, Grade II.
 - D. Field Quality Control Testing Agency Qualifications: An independent agency, acceptable to authorities having jurisdiction, qualified in accordance with ASTM C1077 and ASTM E329 for testing indicated.
 1. Personnel conducting field tests shall be qualified as an ACI Concrete Field Testing Technician, Grade 1, in accordance with ACI CPP 610.1 or an equivalent certification program.
- 1.8 PRECONSTRUCTION TESTING
- A. Preconstruction Testing Service: Owner will engage a qualified testing agency to perform preconstruction testing on each concrete mixture.
- 1.9 DELIVERY, STORAGE, AND HANDLING
- A. Comply with ASTM C94/C94M and ACI 301.
- 1.10 FIELD CONDITIONS
- A. Cold-Weather Placement: Comply with ACI 301 and ACI 306.1 and as follows.
 1. Protect concrete work from physical damage or reduced strength that could be caused by frost, freezing actions, or low temperatures.
 2. When average high and low temperature is expected to fall below 40 deg F for three successive days, maintain delivered concrete mixture temperature within the temperature range required by ACI 301.
 3. Do not use frozen materials or materials containing ice or snow.
 4. Do not place concrete in contact with surfaces less than 35 deg F, other than reinforcing steel.
 5. Do not use calcium chloride, salt, or other materials containing antifreeze agents or chemical accelerators unless otherwise specified and approved in mixture designs.
 - B. Hot-Weather Placement: Comply with ACI 301 and ACI 305.1, and as follows:
 1. Maintain concrete temperature at time of discharge to not exceed 95 deg F.
 2. Fog-spray forms, steel reinforcement, and subgrade just before placing concrete. Keep subgrade uniformly moist without standing water, soft spots, or dry areas.

PART 2 - PRODUCTS

2.1 CONCRETE, GENERAL

- A. ACI Publications: Comply with ACI 301 unless modified by requirements in the Contract Documents.

2.2 CONCRETE MATERIALS

A. Source Limitations:

- 1. Obtain all concrete mixtures from a single ready-mixed concrete manufacturer for entire Project.
- 2. Obtain each type or class of cementitious material of the same brand from the same manufacturer's plant.
- 3. Obtain aggregate from single source.
- 4. Obtain each type of admixture from single source from single manufacturer.

B. Cementitious Materials:

- 1. Portland Cement: ASTM C150/C150M, Type I.
- 2. Fly Ash: ASTM C618, Class C or F.
- 3. Slag Cement: ASTM C989/C989M, Grade 100 or 120.
- 4. Silica Fume: ASTM C1240 amorphous silica.

C. Normal-Weight Aggregates: ASTM C33/C33M, Class 3S coarse aggregate or better, graded. Provide aggregates from a single source.

- 1. Maximum Coarse-Aggregate Size: 3/4-inch nominal.
- 2. Fine Aggregate: Free of materials with deleterious reactivity to alkali in cement.

D. Air-Entraining Admixture: ASTM C260/C260M.

E. Chemical Admixtures: Certified by manufacturer to be compatible with other admixtures that do not contribute water-soluble chloride ions exceeding those permitted in hardened concrete. Do not use calcium chloride or admixtures containing calcium chloride.

- 1. Water-Reducing Admixture: ASTM C494/C494M, Type A.
- 2. Retarding Admixture: ASTM C494/C494M, Type B.
- 3. Water-Reducing and -Retarding Admixture: ASTM C494/C494M, Type D.
- 4. High-Range, Water-Reducing Admixture: ASTM C494/C494M, Type F.
- 5. High-Range, Water-Reducing and -Retarding Admixture: ASTM C494/C494M, Type G.
- 6. Plasticizing and Retarding Admixture: ASTM C1017/C1017M, Type II.

F. Water and Water Used to Make Ice: ASTM C94/C94M, potable.

2.3 VAPOR RETARDERS

- A. Sheet Vapor Retarder: ASTM E 1745, Class A. Include manufacturer's recommended adhesive or pressure-sensitive tape.

1. Products:

- a. W.R Meadows, Inc; Perminator 15 mil.
- b. Steel Industries, LCC; Stego Wrap, 15 mil.
- c. ISI Building Products; Viper II 15 mil.

2.4 LIQUID FLOOR TREATMENTS

- A. Penetrating Liquid Floor Treatment: Clear, chemically reactive, waterborne solution of inorganic silicate or silicate materials and proprietary components; odorless; that penetrates, hardens, and densifies concrete surfaces.
- B. Penetrating Liquid Floor Treatment, Sallyport Garage: Clear, chemically reactive, waterborne solution of inorganic silicate or silicate materials and proprietary components; odorless; that penetrates, hardens, and densifies concrete surfaces.

1. Products: Subject to compliance with requirements, provide one of the following:

- a. Dayton Superior; Pentra-Hard EDH Exterior Densifier.
- b. Approved Equal.

- C. Penetrating Liquid Floor Finish, Typical:

1. Products: Subject to compliance with requirements, provide one of the following:

- a. Dayton Superior; Pentra-Hard Guard.
- b. Scofield Formula One Guard W.
- c. Approved Equal.

2.5 CURING MATERIALS

- A. Evaporation Retarder: Waterborne, monomolecular film forming, manufactured for application to fresh concrete.

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

- a. BASF Corporation; Construction Systems.
- b. ChemMasters, Inc.
- c. Dayton Superior.
- d. Euclid Chemical Company (The); an RPM company.
- e. L&M Construction Chemicals, Inc.

- f. Sika Corporation.
 - g. W. R. Meadows, Inc.
- B. Absorptive Cover: AASHTO M 182, Class 2, burlap cloth made from jute or kenaf, weighing approximately 9 oz./sq. yd. when dry.
- C. Moisture-Retaining Cover: ASTM C171, polyethylene film burlap-polyethylene sheet.
 - 1. Color:
 - a. Ambient Temperature Below 50 deg F: Black.
 - b. Ambient Temperature between 50 deg F and 85 deg F: Any color.
 - c. Ambient Temperature Above 85 deg F: White.
- D. Water: Potable or complying with ASTM C1602/C1602M.

2.6 RELATED MATERIALS

- A. Epoxy Bonding Adhesive: ASTM C881, two-component epoxy resin, capable of humid curing and bonding to damp surfaces, of class suitable for application temperature and of grade and class to suit requirements, and as follows:
 - 1. Types IV and V, load bearing, for bonding hardened or freshly mixed concrete to hardened concrete.

2.7 REPAIR MATERIALS

- A. Repair Underlayment: Cement-based, polymer-modified, self-leveling product that can be applied in thicknesses from 1/8-inch and that can be feathered at edges to match adjacent floor elevations.
 - 1. Cement Binder: ASTM C150/C150M Portland cement or hydraulic or blended hydraulic cement, as defined in ASTM C219.
 - 2. Primer: Product of underlayment manufacturer recommended for substrate, conditions, and application.
 - 3. Aggregate: Well-graded, washed gravel, 1/8 to 1/4-inch or coarse sand, as recommended by underlayment manufacturer.
 - 4. Compressive Strength: Not less than 4100 psi at 28 days when tested in accordance with ASTM C109/C109M.
- B. Repair Overlayment: Cement-based, polymer-modified, self-leveling product that can be applied in thicknesses from 1/4 inch and that can be filled in over a scarified surface to match adjacent floor elevations.
 - 1. Cement Binder: ASTM C150/C150M Portland cement or hydraulic or blended hydraulic cement, as defined in ASTM C219.

2. Primer: Product of topping manufacturer recommended for substrate, conditions, and application.
3. Aggregate: Well-graded, washed gravel, 1/8 to 1/4-inch or coarse sand as recommended by topping manufacturer.
4. Compressive Strength: Not less than 5000 psi at 28 days when tested in accordance with ASTM C109/C109M.

2.8 CONCRETE MIXTURES, GENERAL

- A. Prepare design mixtures for each type and strength of concrete, proportioned on the basis of laboratory trial mixture or field test data, or both, in accordance with ACI 301.
 1. Use a qualified testing agency for preparing and reporting proposed mixture designs, based on laboratory trial mixtures.
- B. Cementitious Materials: Limit percentage, by weight, of cementitious materials other than portland cement in concrete as follows:
 1. Fly Ash or Other Pozzolans: 25 percent by mass.
 2. Slag Cement: 50 percent by mass.
 3. Silica Fume: 10 percent by mass.
 4. Total of Fly Ash or Other Pozzolans, Slag Cement, and Silica Fume: 50 percent by mass, with fly ash or pozzolans not exceeding 25 percent by mass and silica fume not exceeding 10 percent by mass.
 5. Total of Fly Ash or Other Pozzolans and Silica Fume: 35 percent by mass with fly ash or pozzolans not exceeding 25 percent by mass and silica fume not exceeding 10 percent by mass.
- C. Admixtures: Use admixtures in accordance with manufacturer's written instructions.
 1. Use water-reducing high-range water-reducing or plasticizing admixture in concrete, as required, for placement and workability.
 2. Use water-reducing and -retarding admixture when required by high temperatures, low humidity, or other adverse placement conditions.
 3. Use water-reducing admixture in pumped concrete, concrete for heavy-use industrial slabs concrete for parking structure slabs, and concrete with a w/cm below 0.50.

2.9 CONCRETE MIXTURES FOR BUILDING ELEMENTS

- A. Footings and Foundation Walls: Normal-weight concrete.
 1. Minimum Compressive Strength: 4000 psi at 28 days.
 2. Maximum W/C Ratio: 0.42.
 3. Slump Limit: 4 inches, plus or minus 1-inch.
 4. Air Content: 6 percent, plus or minus 1.5 percent at point of delivery for 3/4-inch nominal maximum aggregate size.

B. Slabs-on-Grade: Normal-weight concrete.

1. Minimum Compressive Strength: 4000 psi at 28 days.
2. Maximum W/C Ratio: 0.42.
3. Minimum Cementitious Materials Content: 540 lb/cu. yd.
4. Slump Limit: 4 inches, plus or minus 1 inch.
5. Air Content: 6 percent, plus or minus 1.5 percent at point of delivery for 3/4-inch nominal maximum aggregate size.
6. Air Content: Do not allow air content of trowel-finished floors to exceed 3 percent.

C. Concrete Toppings: Normal-weight concrete.

1. Minimum Compressive Strength: 4000 psi at 28 days.
2. Maximum Water/Cement Ratio: 0.35.
3. Slump Limit: 8 inches, plus or minus 1 inch.
4. Air Content: Do not allow air content of trowel-finished toppings to exceed 3 percent.

2.10 CONCRETE MIXING

- A. Ready-Mixed Concrete: Measure, batch, mix, and deliver concrete in accordance with ASTM C94 and ASTM C1116, and furnish batch ticket information.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verification of Conditions:

1. Before placing concrete, verify that installation of concrete forms, accessories, and reinforcement, and embedded items is complete and that required inspections have been performed.
2. Do not proceed until unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Provide reasonable auxiliary services to accommodate field testing and inspections, acceptable to testing agency, including the following:

1. Daily access to the Work.
2. Incidental labor and facilities necessary to facilitate tests and inspections.
3. Secure space for storage, initial curing, and field curing of test samples, including source of water and continuous electrical power at Project site during site curing period for test samples.
4. Security and protection for test samples and for testing and inspection equipment at Project site.

3.3 INSTALLATION OF EMBEDDED ITEMS

- A. Place and secure anchorage devices and other embedded items required for adjoining Work that is attached to or supported by cast-in-place concrete.
 - 1. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
 - 2. Install anchor rods, accurately located, to elevations required and complying with tolerances in Section 7.5 of ANSI/AISC 303.

3.4 INSTALLATION OF VAPOR RETARDER

- A. Sheet Vapor Retarders: Place, protect, and repair sheet vapor retarder in accordance with ASTM E1643 and manufacturer's written instructions.
 - 1. Install vapor retarder with longest dimension parallel with direction of concrete pour.
 - 2. Face laps away from exposed direction of concrete pour.
 - 3. Lap vapor retarder over footings and grade beams not less than 6 inches, sealing vapor retarder to concrete.
 - 4. Lap joints 6 inches and seal with manufacturer's recommended tape.
 - 5. Terminate vapor retarder at the top of floor slabs, grade beams, and pile caps, sealing entire perimeter to floor slabs, grade beams, foundation walls, or pile caps.
 - 6. Seal penetrations in accordance with vapor retarder manufacturer's instructions.
 - 7. Protect vapor retarder during placement of reinforcement and concrete.
 - a. Repair damaged areas by patching with vapor retarder material, overlapping damages area by 6 inches on all sides, and sealing to vapor retarder.

3.5 JOINTS

- A. Construct joints true to line, with faces perpendicular to surface plane of concrete.
- B. Construction Joints: Coordinate with floor slab pattern and concrete placement sequence.
 - 1. Install so strength and appearance of concrete are not impaired, at locations indicated on Drawings or as approved by Architect.
 - 2. Place joints perpendicular to main reinforcement.
 - a. Continue reinforcement across construction joints unless otherwise indicated.
 - b. Do not continue reinforcement through sides of strip placements of floors and slabs.
 - 3. Form keyed joints as indicated. Embed keys at least 1-1/2-inches into concrete.
 - 4. Locate horizontal joints in walls and columns at underside of floors, slabs, beams, and girders and at the top of footings or floor slabs.

5. Space vertical joints in walls as indicated on Drawings. Unless otherwise indicated on Drawings, locate vertical joints beside piers integral with walls, near corners, and in concealed locations where possible.
 6. Use epoxy-bonding adhesive at locations where fresh concrete is placed against hardened or partially hardened concrete surfaces.
- C. Control Joints in Slabs-on-Ground: Form weakened-plane control joints, sectioning concrete into areas as indicated. Construct control joints for a depth equal to at least one-fourth of concrete thickness as follows:
1. Sawed Joints: Form control joints with power saws equipped with shatterproof abrasive or diamond-rimmed blades. Cut 1/8-inch-wide joints into concrete when cutting action does not tear, abrade, or otherwise damage surface and before concrete develops random cracks.
- D. Isolation Joints in Slabs-on-Ground: After removing formwork, install joint-filler strips at slab junctions with vertical surfaces, such as column pedestals, foundation walls, grade beams, and other locations, as indicated.
1. Extend joint-filler strips full width and depth of joint, terminating flush with finished concrete surface unless otherwise indicated on Drawings.
 2. Terminate full-width joint-filler strips not less than 1/2-inch or more than 1-inch below finished concrete surface, where joint sealants, specified in Section 079200 "Joint Sealants," are indicated.
 3. Install joint-filler strips in lengths as long as practicable. Where more than one length is required, lace or clip sections together.

3.6 CONCRETE PLACEMENT

- A. Before placing concrete, verify that installation of formwork, reinforcement, embedded items, and vapor retarder is complete and that required inspections are completed.
1. Immediately prior to concrete placement, inspect vapor retarder for damage and deficient installation, and repair defective areas.
 2. Provide continuous inspection of vapor retarder during concrete placement and make necessary repairs to damaged areas as Work progresses.
- B. Notify Architect and testing and inspection agencies 24 hours prior to commencement of concrete placement.
- C. Do not add water to concrete during delivery, at Project site, or during placement unless approved by Architect in writing, but not to exceed the amount indicated on the concrete delivery ticket.
1. Do not add water to concrete after adding high-range water-reducing admixtures to mixture.

- D. Before test sampling and placing concrete, water may be added at Project site, subject to limitations of ACI 301, but not to exceed the amount indicated on the concrete delivery ticket.
 - 1. Do not add water to concrete after adding high-range water-reducing admixtures to mixture.
- E. Deposit concrete continuously in one layer or in horizontal layers of such thickness that no new concrete is placed on concrete that has hardened enough to cause seams or planes of weakness.
 - 1. If a section cannot be placed continuously, provide construction joints as indicated.
 - 2. Deposit concrete to avoid segregation.
 - 3. Deposit concrete in horizontal layers of depth not to exceed formwork design pressures and in a manner to avoid inclined construction joints.
 - 4. Consolidate placed concrete with mechanical vibrating equipment in accordance with ACI 301.
 - a. Do not use vibrators to transport concrete inside forms.
 - b. Insert and withdraw vibrators vertically at uniformly spaced locations to rapidly penetrate placed layer and at least 6 inches into preceding layer.
 - c. Do not insert vibrators into lower layers of concrete that have begun to lose plasticity.
 - d. At each insertion, limit duration of vibration to time necessary to consolidate concrete, and complete embedment of reinforcement and other embedded items without causing mixture constituents to segregate.
- F. Deposit and consolidate concrete for floors and slabs in a continuous operation, within limits of construction joints, until placement of a panel or section is complete.
 - 1. Do not place concrete floors and slabs in a checkerboard sequence.
 - 2. Consolidate concrete during placement operations, so concrete is thoroughly worked around reinforcement and other embedded items and into corners.
 - 3. Maintain reinforcement in position on chairs during concrete placement.
 - 4. Screed slab surfaces with a straightedge and strike off to correct elevations.
 - 5. Level concrete, cut high areas, and fill low areas.
 - 6. Slope surfaces uniformly to drains where required.
 - 7. Begin initial floating using bull floats or darbies to form a uniform and open-textured surface plane, before excess bleedwater appears on the surface.
 - 8. Do not further disturb slab surfaces before starting finishing operations.

3.7 FINISHING FORMED SURFACES

- A. As-Cast Surface Finishes:
 - 1. ACI 301 Surface Finish SF-1.0: As-cast concrete texture imparted by form-facing material.
 - a. Patch voids larger than 1-1/2-inches wide or 1/2-inch deep.

- b. Remove projections larger than 1-inch.
 - c. Tie holes do not require patching.
 - d. Surface Tolerance: ACI 117 Class D.
 - e. Apply to concrete surfaces not exposed to view.
 - 2. ACI 301 Surface Finish SF-3.0:
 - a. Patch voids larger than 3/4-inch wide or 1/2-inch deep.
 - b. Remove projections larger than 1/8-inch.
 - c. Patch tie holes.
 - d. Surface Tolerance: ACI 117 Class A.
 - e. Locations: Apply to concrete surfaces exposed to view.
- B. Rubbed Finish: Apply the following to as cast surface finishes where indicated on Drawings:
- 1. Grout-Cleaned Rubbed Finish:
 - a. Clean concrete surfaces after contiguous surfaces are completed and accessible.
 - b. Do not clean concrete surfaces as Work progresses.
 - c. Mix 1-part Portland cement to 1-1/2 parts fine sand, complying with ASTM C144 or ASTM C404, by volume, with sufficient water to produce a mixture with the consistency of thick paint. Add white Portland cement in amounts determined by trial patches, so color of dry grout matches adjacent surfaces.
 - d. Wet concrete surfaces.
 - e. Scrub grout into voids and remove excess grout. When grout whitens, rub surface with clean burlap, and keep surface damp by fog spray for at least 36 hours.
- C. Related Unformed Surfaces:
- 1. At tops of walls, horizontal offsets, and similar unformed surfaces adjacent to formed surfaces, strike off smooth and finish with a color and texture matching adjacent formed surfaces.
 - 2. Continue final surface treatment of formed surfaces uniformly across adjacent unformed surfaces unless otherwise indicated.

3.8 FINISHING FLOORS AND SLABS

- A. Comply with ACI 302.1R recommendations for screeding, restraightening, and finishing operations for concrete surfaces. Do not wet concrete surfaces.
- B. Scratch Finish:
 - 1. While still plastic, texture concrete surface that has been screeded and bull-floated or darbied.
 - 2. Use stiff brushes, brooms, or rakes to produce a profile depth of 1/4-inch in one direction.
 - 3. Apply scratch finish to surfaces to receive mortar setting beds for bonded cementitious floor finishes.

C. Float Finish:

1. When bleedwater sheen has disappeared and concrete surface has stiffened sufficiently to permit operation of specific float apparatus, consolidate concrete surface with power-driven floats or by hand floating if area is small or inaccessible to power-driven floats.
2. Repeat float passes and restraighening until surface is left with a uniform, smooth, granular texture and complies with ACI 117 tolerances for conventional concrete.
3. Apply float finish to surfaces to receive trowel finish and resinous terrazzo finish.

D. Trowel Finish:

1. After applying float finish, apply first troweling and consolidate concrete by hand or power-driven trowel.
2. Continue troweling passes and restraighen until surface is free of trowel marks and uniform in texture and appearance.
3. Grind smooth any surface defects that would telegraph through applied coatings or floor coverings.
4. Do not add water to concrete surface.
5. Do not apply hard-troweled finish to concrete, which has a total air content greater than 3 percent.
6. Apply a trowel finish to surfaces exposed to view or to be covered with resilient flooring, carpet, ceramic or quarry tile set over a cleavage membrane, paint, or another thin-film-finish coating system.
7. Finish surfaces to the following tolerances, in accordance with ASTM E1155, for a randomly trafficked floor surface:

a. Slabs on Ground:

- 1) Specified overall values of flatness, F_F 25; and of levelness, F_L 20; with minimum local values of flatness, F_F 17; and of levelness, F_L 15.

E. Trowel and Fine-Broom Finish: Apply a first trowel finish to surfaces where ceramic or quarry tile is to be installed by either thickset or thinset method. While concrete is still plastic, slightly scarify surface with a fine broom perpendicular to main traffic route.

1. Coordinate required final finish with Architect before application.
2. Comply with flatness and levelness tolerances for trowel-finished floor surfaces.

F. Broom Finish: Apply a broom finish to exterior concrete platforms, steps, ramps, and locations indicated on Drawings.

1. Immediately after float finishing, slightly roughen trafficked surface by brooming with fiber-bristle broom perpendicular to main traffic route.
2. Coordinate required final finish with Architect before application.

3.9 INSTALLATION OF MISCELLANEOUS CONCRETE ITEMS

A. Filling In:

1. Fill in holes and openings left in concrete structures after Work of other trades is in place unless otherwise indicated.
2. Mix, place, and cure concrete, as specified, to blend with in-place construction.
3. Provide other miscellaneous concrete filling indicated or required to complete the Work.

B. Equipment Bases and Foundations:

1. Coordinate sizes and locations of concrete bases with actual equipment provided.
2. Construct concrete bases 4-inches high unless otherwise indicated on Drawings, and extend base not less than 6-inches in each direction beyond the maximum dimensions of supported equipment unless otherwise indicated on Drawings, or unless required for seismic anchor support.
3. Minimum Compressive Strength: 4000 psi at 28 days.
4. Install dowel rods to connect concrete base to concrete floor. Unless otherwise indicated, install dowel rods on 18-inch centers around the full perimeter of concrete base.
5. For supported equipment, install epoxy-coated anchor bolts that extend through concrete base and anchor into structural concrete substrate.
6. Prior to pouring concrete, place and secure anchorage devices.
 - a. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
 - b. Cast anchor-bolt insert into bases.
 - c. Install anchor bolts to elevations required for proper attachment to supported equipment.

3.10 CONCRETE CURING

A. Protect freshly placed concrete from premature drying and excessive cold or hot temperatures.

1. Comply with ACI 301 and ACI 306.1 for cold weather protection during curing.
2. Comply with ACI 301 and ACI 305.1 for hot-weather protection during curing.
3. Maintain moisture loss no more than 0.2 lb/sq. ft. x h before and during finishing operations.

B. Curing Formed Surfaces: Comply with ACI 308.1 as follows:

1. Cure formed concrete surfaces, including underside of beams, supported slabs, and other similar surfaces.
2. Cure concrete containing color pigments in accordance with color pigment manufacturer's instructions.
3. If forms remain during curing period, moist cure after loosening forms.

4. If removing forms before end of curing period, continue curing for remainder of curing period, as follows:
 - a. Continuous Fogging: Maintain standing water on concrete surface until final setting of concrete.
 - b. Continuous Sprinkling: Maintain concrete surface continuously wet.
 - c. Absorptive Cover: Pre-dampen absorptive material before application; apply additional water to absorptive material to maintain concrete surface continuously wet.
 - d. Water-Retention Sheetting Materials: Cover exposed concrete surfaces with sheetting material, taping, or lapping seams.
- C. Curing Unformed Surfaces: Comply with ACI 308.1as follows:
 1. Begin curing immediately after finishing concrete.
 2. Interior Concrete Floors:
 - a. Floors to Receive Floor Coverings Specified in Other Sections: Contractor has option of the following:
 - 1) Absorptive Cover: As soon as concrete has sufficient set to permit application without marring concrete surface, install prewetted absorptive cover over entire area of floor.
 - a) Lap edges and ends of absorptive cover not less than 12-inches.
 - b) Maintain absorptive cover water saturated, and in place, for duration of curing period, but not less than seven days.
 - 2) Moisture-Retaining-Cover Curing: Cover concrete surfaces with moisture-retaining cover for curing concrete, placed in widest practicable width, with sides and ends lapped at least 12-inches, and sealed by waterproof tape or adhesive.
 - a) Immediately repair any holes or tears during curing period, using cover material and waterproof tape.
 - b) Cure for not less than seven (7) days.
 - 3) Ponding or Continuous Sprinkling of Water: Maintain concrete surfaces continuously wet for not less than seven (7) days, utilizing one, or a combination of, the following:
 - a) Water.
 - b) Continuous water-fog spray.
 - b. Floors to Receive Penetrating Liquid Floor Treatments: Contractor has option of the following:

- 1) Absorptive Cover: As soon as concrete has sufficient set to permit application without marring concrete surface, install prewetted absorptive cover over entire area of floor.
 - a) Lap edges and ends of absorptive cover not less than 12-inches.
 - b) Maintain absorptive cover water saturated, and in place, for duration of curing period, but not less than seven (7) days.
- 2) Moisture-Retaining-Cover Curing: Cover concrete surfaces with moisture-retaining cover for curing concrete, placed in widest practicable width, with sides and ends lapped at least 12 inches, and sealed by waterproof tape or adhesive.
 - a) Immediately repair any holes or tears during curing period, using cover material and waterproof tape.
 - b) Cure for not less than seven days.
- 3) Ponding or Continuous Sprinkling of Water: Maintain concrete surfaces continuously wet for not less than seven days, utilizing one, or a combination of, the following:
 - a) Water.
 - b) Continuous water-fog spray.
- 4)

c. Floors to Receive Urethane Flooring:

- 1) As soon as concrete has sufficient set to permit application without marring concrete surface, install prewetted absorptive cover over entire area of floor.
- 2) Rewet absorptive cover, and cover immediately with polyethylene moisture-retaining cover with edges lapped 6-inches and sealed in place.
- 3) Secure polyethylene moisture-retaining cover in place to prohibit air from circulating under polyethylene moisture-retaining cover.
- 4) Leave absorptive cover and polyethylene moisture-retaining cover in place for duration of curing period, but not less than 28 days.

3.11 TOLERANCES

- A. Conform to ACI 117.

3.12 APPLICATION OF LIQUID FLOOR TREATMENTS

- A. Penetrating Liquid Floor Treatment: Prepare, apply, and finish penetrating liquid floor treatment in accordance with manufacturer's written instructions.

1. Remove curing compounds, sealers, oil, dirt, laitance, and other contaminants and complete surface repairs.
 2. Do not apply to concrete that is less than seven days' old.
 3. Apply liquid until surface is saturated, scrubbing into surface until a gel forms; rewet; and repeat brooming or scrubbing.
 4. Rinse with water; remove excess material until surface is dry.
 5. Apply a second coat in a similar manner if surface is rough or porous.
- B. Sealing Coat: Uniformly apply a continuous sealing coat of curing and sealing compound to hardened concrete by power spray or roller in accordance with manufacturer's written instructions.

3.13 JOINT FILLING

- A. Prepare, clean, and install joint filler in accordance with manufacturer's written instructions.
1. Defer joint filling until concrete has aged at least one month(s).
 2. Do not fill joints until construction traffic has permanently ceased.
- B. Remove dirt, debris, saw cuttings, curing compounds, and sealers from joints; leave contact faces of joints clean and dry.
- C. Install semirigid joint filler full depth in saw-cut joints and at least 2-inches deep in formed joints.
- D. Overfill joint, and trim joint filler flush with top of joint after hardening.

3.14 CONCRETE SURFACE REPAIRS

- A. Defective Concrete:
1. Repair and patch defective areas when approved by Architect.
 2. Remove and replace concrete that cannot be repaired and patched to Architect's approval.
- B. Patching Mortar: Mix dry-pack patching mortar, consisting of 1-part Portland cement to 2-1/2 parts fine aggregate passing a No. 16 sieve, using only enough water for handling and placing.
- C. Repairing Formed Surfaces: Surface defects include color and texture irregularities, cracks, spalls, air bubbles, honeycombs, rock pockets, fins and other projections on the surface, and stains and other discolorations that cannot be removed by cleaning.
1. Immediately after form removal, cut out honeycombs, rock pockets, and voids more than 1/2-inch in any dimension to solid concrete.
 - a. Limit cut depth to 3/4-inch.
 - b. Make edges of cuts perpendicular to concrete surface.

- c. Clean, dampen with water, and brush-coat holes and voids with bonding agent.
 - d. Fill and compact with patching mortar before bonding agent has dried.
 - e. Fill form-tie voids with patching mortar or cone plugs secured in place with bonding agent.
 2. Repair defects on surfaces exposed to view by blending white Portland cement and standard Portland cement, so that, when dry, patching mortar matches surrounding color.
 - a. Patch a test area at inconspicuous locations to verify mixture and color match before proceeding with patching.
 - b. Compact mortar in place and strike off slightly higher than surrounding surface.
 3. Repair defects on concealed formed surfaces that will affect concrete's durability and structural performance as determined by Architect.
- D. Repairing Unformed Surfaces:
1. Test unformed surfaces, such as floors and slabs, for finish, and verify surface tolerances specified for each surface.
 - a. Correct low and high areas.
 - b. Test surfaces sloped to drain for trueness of slope and smoothness; use a sloped template.
 2. Repair finished surfaces containing surface defects, including spalls, popouts, honeycombs, rock pockets, crazing, and cracks in excess of 0.01-inch wide or that penetrate to reinforcement or completely through unreinforced sections regardless of width, and other objectionable conditions.
 3. After concrete has cured at least 14 days, correct high areas by grinding.
 4. Correct localized low areas during, or immediately after, completing surface-finishing operations by cutting out low areas and replacing with patching mortar.
 - a. Finish repaired areas to blend into adjacent concrete.
 5. Correct other low areas scheduled to receive floor coverings with a repair underlayment.
 - a. Prepare, mix, and apply repair underlayment and primer in accordance with manufacturer's written instructions to produce a smooth, uniform, plane, and level surface.
 - b. Feather edges to match adjacent floor elevations.
 6. Correct other low areas scheduled to remain exposed with repair topping.
 - a. Cut out low areas to ensure a minimum repair topping depth of 1/4-inch to match adjacent floor elevations.

- b. Prepare, mix, and apply repair topping and primer in accordance with manufacturer's written instructions to produce a smooth, uniform, plane, and level surface.
- 7. Repair defective areas, except random cracks and single holes 1-inch or less in diameter, by cutting out and replacing with fresh concrete.
 - a. Remove defective areas with clean, square cuts, and expose steel reinforcement with at least a 3/4-inch clearance all around.
 - b. Dampen concrete surfaces in contact with patching concrete and apply bonding agent.
 - c. Mix patching concrete of same materials and mixture as original concrete, except without coarse aggregate.
 - d. Place, compact, and finish to blend with adjacent finished concrete.
 - e. Cure in same manner as adjacent concrete.
- 8. Repair random cracks and single holes 1-inch or less in diameter with patching mortar.
 - a. Groove top of cracks and cut out holes to sound concrete, and clean off dust, dirt, and loose particles.
 - b. Dampen cleaned concrete surfaces and apply bonding agent.
 - c. Place patching mortar before bonding agent has dried.
 - d. Compact patching mortar and finish to match adjacent concrete.
 - e. Keep patched area continuously moist for at least 72 hours.
- E. Perform structural repairs of concrete, subject to Architect's approval, using epoxy adhesive and patching mortar.
- F. Repair materials and installation not specified above may be used, subject to Architect's approval.

3.15 FIELD QUALITY CONTROL

- A. Special Inspections: Owner will engage a special inspector to perform field tests and inspections and prepare testing and inspection reports.
- B. Testing Agency: Owner will engage a qualified testing and inspecting agency to perform tests and inspections and to submit reports.
 - 1. Testing agency shall be responsible for providing curing container for composite samples on Site and verifying that field-cured composite samples are cured in accordance with ASTM C31/C31M.
 - 2. Testing agency shall immediately report to Architect, Contractor, and concrete manufacturer any failure of Work to comply with Contract Documents.
 - 3. Testing agency shall report results of tests and inspections, in writing, to Owner, Architect, Contractor, and concrete manufacturer within 48 hours of inspections and tests.

- a. Test reports shall include reporting requirements of ASTM C31/C31M, ASTM C39/C39M, and ACI 301, including the following as applicable to each test and inspection:
 - 1) Project name.
 - 2) Name of testing agency.
 - 3) Names and certification numbers of field and laboratory technicians performing inspections and testing.
 - 4) Name of concrete manufacturer.
 - 5) Date and time of inspection, sampling, and field testing.
 - 6) Date and time of concrete placement.
 - 7) Location in Work of concrete represented by samples.
 - 8) Date and time sample was obtained.
 - 9) Truck and batch ticket numbers.
 - 10) Design compressive strength at 28 days.
 - 11) Concrete mixture designation, proportions, and materials.
 - 12) Field test results.
 - 13) Information on storage and curing of samples before testing, including curing method and maximum and minimum temperatures during initial curing period.
 - 14) Type of fracture and compressive break strengths at seven days and 28 days.
- C. Batch Tickets: For each load delivered, submit three copies of batch delivery ticket to testing agency, indicating quantity, mix identification, admixtures, design strength, aggregate size, design air content, design slump at time of batching, and amount of water that can be added at Project site.
- D. Inspections:
 1. Headed bolts and studs.
 2. Verification of use of required design mixture.
 3. Concrete placement, including conveying and depositing.
 4. Curing procedures and maintenance of curing temperature.
 5. Verification of concrete strength before removal of shores and forms from beams and slabs.
 6. Batch Plant Inspections: On a random basis, as determined by Architect.
- E. Concrete Tests: Testing of composite samples of fresh concrete obtained in accordance with ASTM C 172/C 172M shall be performed in accordance with the following requirements:
 1. Testing Frequency: Obtain one composite sample for each day's pour of each concrete mixture exceeding 5 cu. yd., but less than 25 cu. yd., plus one set for each additional 50 cu. yd. or fraction thereof.
 - a. When frequency of testing provides fewer than five compressive-strength tests for each concrete mixture, testing shall be conducted from at least five randomly selected batches or from each batch if fewer than five are used.

2. Slump: ASTM C143/C143M:
 - a. One test at point of placement for each composite sample, but not less than one test for each day's pour of each concrete mixture.
 - b. Perform additional tests when concrete consistency appears to change.
3. Slump Flow: ASTM C1611/C1611M:
 - a. One test at point of placement for each composite sample, but not less than one test for each day's pour of each concrete mixture.
 - b. Perform additional tests when concrete consistency appears to change.
4. Air Content: ASTM C231/C231M pressure method, for normal-weight concrete.
 - a. One test for each composite sample, but not less than one test for each day's pour of each concrete mixture.
5. Concrete Temperature: ASTM C1064/C1064M:
 - a. One test hourly when air temperature is 40 deg F and below or 80 deg F and above, and one test for each composite sample.
6. Unit Weight: ASTM C567/C567M fresh unit weight of structural lightweight concrete.
 - a. One test for each composite sample, but not less than one test for each day's pour of each concrete mixture.
7. Compression Test Specimens: ASTM C31/C31M:
 - a. Cast and laboratory cure two sets of two 6-inch by 12-inch cylinder specimens for each composite sample.
 - b. Cast, initial cure, and field cure two sets of two standard cylinder specimens for each composite sample.
8. Compressive-Strength Tests: ASTM C39/C39M.
 - a. Test one set of two laboratory-cured specimens at seven days and one set of two specimens at 28 days.
 - b. Test one set of two field-cured specimens at seven days and one set of two specimens at 28 days.
 - c. A compressive-strength test shall be the average compressive strength from a set of two specimens obtained from same composite sample and tested at age indicated.
9. When strength of field-cured cylinders is less than 85 percent of companion laboratory-cured cylinders, Contractor shall evaluate operations and provide corrective procedures for protecting and curing in-place concrete.

10. Strength of each concrete mixture will be satisfactory if every average of any three consecutive compressive-strength tests equals or exceeds specified compressive strength, and no compressive-strength test value falls below specified compressive strength by more than 500 psi if specified compressive strength is 5000 psi, or no compressive strength test value is less than 10 percent of specified compressive strength if specified compressive strength is greater than 5000 psi.
11. Nondestructive Testing: Impact hammer, sonoscope, or other nondestructive device may be permitted by Architect but will not be used as sole basis for approval or rejection of concrete.
12. Additional Tests:
 - a. Testing and inspecting agency shall make additional tests of concrete when test results indicate that slump, air entrainment, compressive strengths, or other requirements have not been met, as directed by Architect.
 - b. Testing and inspecting agency may conduct tests to determine adequacy of concrete by cored cylinders complying with ASTM C42/C42M or by other methods as directed by Architect.
 - 1) Acceptance criteria for concrete strength shall be in accordance with ACI 301 section 1.6.6.3.
13. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.
14. Correct deficiencies in the Work that test reports and inspections indicate do not comply with the Contract Documents.

- F. Measure floor and slab flatness and levelness in accordance with ASTM E1155 within 48 hours of completion of floor finishing and promptly report test results to Architect.

3.16 PROTECTION

- A. Protect concrete surfaces as follows:

1. Protect from petroleum stains.
2. Diaper hydraulic equipment used over concrete surfaces.
3. Prohibit vehicles from interior concrete slabs.
4. Prohibit use of pipe-cutting machinery over concrete surfaces.
5. Prohibit placement of steel items on concrete surfaces.
6. Prohibit use of acids or acidic detergents over concrete surfaces.
7. Protect liquid floor treatment from damage and wear during the remainder of construction period. Use protective methods and materials, including temporary covering, recommended in writing by liquid floor treatments installer.
8. Protect concrete surfaces scheduled to receive surface hardener or polished concrete finish using Floor Slab Protective Covering.

END OF SECTION 033000

SECTION 033616 – REACTIVE CHEMICAL CONCRETE STAIN

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section includes:
 - 1. Chemically stained concrete floor finish.
 - 2. Sealer.
- B. Related Sections:
 - 1. Section 033000 "Cast-In-Place Concrete" for general concrete applications.
 - 2. Section 079200 – "Joint Sealants" for colored sealant installed in paving joints.

1.3 REFERENCES

- A. ASTM International (ASTM):
 - 1. ASTM C 171: Standard Specification for Sheet Materials for Curing Concrete.
 - 2. ASTM C 309: Standard Specification for Liquid Membrane-Forming Compounds for Curing Concrete.
 - 3. ASTM F 1869: Standard Test Method for Measuring Moisture Vapor Emission Rate of Concrete Subfloor Using Anhydrous Calcium Chloride.

1.4 SUBMITTALS

- A. Product Data: Manufacturer's technical data, including Material Safety Data Sheet (MSDS) and installation instructions, for each product specified.
- B. Qualification Data: For manufacturer and installer.

1.5 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Minimum 10 years of documented experience producing the specified products.

- B. Installer Qualifications: Minimum 5 years of documented experience with work of similar scope and complexity required by this Project and acceptable to, or certified by, concrete stain manufacturer.
- C. Regulatory Requirements:
 - 1. Products to comply with United States Clean Air Act for maximum Volatile Organic compound (VOC) content as specified in this Section.
- D. Material Source: Obtain each specified material from the same source.
- E. Notification: Give a minimum seven (7) calendar days' notice to manufacturer's authorized field representative before date established for commencement of concrete stain work.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Deliver products in original factory unopened, undamaged packaging bearing identification of product, manufacturer, batch number, and expiration date as applicable.
- B. Store products in a location protected from damage, construction activity, and adverse environmental conditions, and away from combustible materials and sources of heat, according to manufacturer's printed instructions and current recommendations.
- C. Handle products according to manufacturer's printed instructions.

1.7 PROJECT CONDITIONS

- A. Environmental Conditions: Maintain an ambient temperature between 50 deg F and 90 deg F during application and at least 48 hours after application.

1.8 PREINSTALLATION CONFERENCE

- A. Seven calendar days prior to scheduled date of installation, conduct a meeting at Project site to discuss requirements, including application methods. Attendees to include Architect, Owner, Contractor, Installer, and manufacturer's authorized field representative.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Basis-of-Design Product: Subject to compliance with requirements provide "Lithochrome Chemstain Classic" as manufactured by L. M. Scofield Company (Scofield) or a comparable product by one of the following:
 - 1. Butterfield Color.

2. The Sherwin Williams Company.

2.2 MATERIALS

- A. Reactive Chemical Concrete Stain: Reactive, water-based solution of metallic salts which react with calcium hydroxide in cured concrete substrates to produce permanent variegated or translucent color effects. Zero VOC content.
 1. Color: As selected by the Architect from manufacturer's standard colors.
- B. Sealer:
 1. Basis-of-Design Product: Subject to compliance with requirements provide "Curaseal-W" as manufactured by L. M. Scofield Company (Scofield) or a comparable product by one of the following:
 - a. Butterfield Color.
 - b. The Sherwin Williams Company.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine areas and conditions under which the concrete stain work will be performed and identify conditions detrimental to the proper and timely completion of the work. Do not proceed until unsatisfactory conditions have been corrected.
- B. Interior Applications: Concrete substrates must have a moisture vapor emission rate of less than 5 lbs./1000 sq. ft. per 24 hour based on a 72 hour test period according to ASTM F 1869.

3.2 PREPARATION

- A. New Concrete: Comply with the following:
 1. Newly placed concrete to sufficiently cure for concrete to become reactive. Minimum cure time is 14 days.
 2. Interior Applications: Minimum cure time of concrete is 30 to 60 days, or longer if necessary to meet the specified water vapor transmission requirements.
 3. Do not use liquid curing materials. Cure concrete flatwork with new, unwrinkled, non-staining, high quality curing paper complying with ASTM C 171. Do not overlap curing paper.
 4. Immediately prior to chemically staining, thoroughly clean concrete to remove any contaminants deleterious to subsequent chemical stain application. Sweep surfaces, then pressure wash or scrub using a rotary floor machine with a Mal-Grit Brush from the Malish Corporation.

Use suitable, non-acidic, high quality commercial detergents to facilitate cleaning. Rinse surfaces after cleaning until rinse water is completely clean. Allow floor to dry completely prior to application of concrete stain.

- a. Pressure Washing: Use a pressure washer equipped with a fan tip and rated for a minimum pressure capability of 4000 psi.

B. Surface Preparation for New or Existing Concrete:

1. Concrete surfaces should be completely penetrable before applying the initial application of chemical stain. The surface of the concrete should be lightly mechanically abraded to remove weak cement paste and contaminants. The final surface preparation should approximate a Concrete Surface Profile of 1, (CSP1 as designated by the International Concrete Repair Institute, Alexandria, Virginia). Methods for mechanical abrasion include:
 - a. Pressure Washing: Use a pressure washer equipped with a fan tip and rated for a minimum pressure capability of 4000 psi.
 - b. Scrubbing with a rotary floor machine with a Mal-Grit Brush from the Malish Corporation.
 - c. Light sanding of the surface.
2. Surfaces should be tested to receive stain by spotting with water. Water should immediately darken the substrate and be readily absorbed. If water beads and does not penetrate or only penetrates in some areas, perform additional surface preparation and testing. On denser concrete floors, sand lightly to open up surfaces. Retest and continue surface preparation until water spots immediately darken and uniformly penetrate concrete surfaces.
3. Rinse concrete substrates until rinse water is completely clean.

C. Scoring: Score decorative jointing in concrete surfaces 1/8-inch deep with diamond blades. Rinse until water is completely clean.

1. Single Color Stain Applications: Score after staining.
2. Multiple Color Stain Applications: Score before staining.

3.3 CHEMICAL STAIN APPLICATION

- A. General: Comply with chemical stain manufacturer's printed instructions and current recommendations.
 1. Do not mix the specified chemical stain with highly alkaline materials. Doing so will result in a dangerous chemical reaction.
- B. Protect surrounding areas, landscaping, and adjacent surfaces from overspray, runoff, and tracking. Divide surfaces into small work sections using walls, joint lines, or other stationary breaks as natural stopping points.

- C. Apply chemical stains at the coverage rate recommended by the manufacturer and use application equipment according to the chemical stain manufacturer's printed instructions. Note the color of the liquid chemical stain will not be the final color produced on the concrete substrate.
- D. Transfer chemical stain to the substrate by brush or spray and immediate scrub into surface. Reaction time depends on wind conditions, temperatures, and humidity levels.
- E. When multiple coats of one or more colors are required, washing and drying between colors is desirable to evaluate the color prior to the next coat.
- F. Rinsing: After the final coat of chemical stain has remained on the surface for a minimum of four hours, neutralize unreacted chemical stain residue and then remove completely prior to sealing. After neutralization, thoroughly rinse surface with clean water several times to remove soluble salts. While rinsing, lightly abrade surface using a low-speed floor machine and red pad to remove residue and weakened surface material. Runoff may stain the adjacent areas or harm plants. Collect rinse water by wet vacuuming or absorbing with an inert material.
 - 1. Failure to completely remove all residue prior to sealing the surface will cause appearance defects, adhesion loss or peeling, reduced durability, and possible bonding failure and delamination of sealer.
 - 2. All stain residue, runoff liquid, and rinse water must be collected and disposed of according to applicable Federal regulations and governing authorities having jurisdiction.

3.4 SEALING APPLICATION

- A. Concrete substrate must be completely dry. Test surface for proper pH prior to applying sealer. A pH value of 7 or higher indicates all acid has been neutralized. If the tested pH value is less than 7, repeat neutralization step until the required pH value is achieved.
- B. Conduct a moisture vapor emission test prior to applying any sealer. Refer to the specific sealer's Technical-Data Bulletin for acceptable MVER.
- C. Apply sealer according the sealer manufacturer's printed instructions at a rate of 300 to 500 square feet per gallon per coat. Maintain a wet edge at all times.
- D. Allow sealer to completely dry before applying additional coats.
- E. Apply second coat of sealer at 90 degrees to the direction of the first coat using the same application method and rates.
- F. Seal horizontal joints in areas subject to pedestrian or vehicular traffic.

3.5 PROTECTION

- B. The General Contractor is responsible for using Temporary Floor Protection throughout the project to safeguard the surface quality of concrete slabs before and after application of decorative finishes or installations of other materials.
- C. All concrete floors that will be not be covered by other materials will be protected throughout the project. The concrete slab must be treated as a finished floor at all times during construction.
- D. Temporary Floor Protection will be removed only while finish work to the concrete is being performed and will be replaced after the final finish has cured sufficiently.
- E. Temporary Floor Protection will be "Proguard Duracover" as manufactured by L. M. Scofield Company, Douglasville, GA (800-800-9900). Seaming of the temporary floor protection will be performed with Scofield Proguard Heavy Duty Seaming Tape or approved comparable product.. Both products will be installed following the manufacturer's published installation procedures.
- F. DO NOT APPLY THE HEAVY-DUTY SEAMING TAPE TO BARE OR FINISHED FLOORS OR WALL SURFACES AT ANY TIME. IT WILL PERMANENTLY DAMAGE THE FLOOR

3.6 MAINTENANCE

- A. Maintain chemically stained and sealed floors by sweeping. Clean spills when they occur and rinse dirt off with water. Wet-clean heavily soiled areas by mopping or by scrubbing with a rotary floor machine equipped with a scrubbing brush and a suitable, high quality commercial detergent. Maintain interior floors that require polishing by using a compatible, premium-grade, emulsion-type, commercial floor polish, according to manufacturer's printed instructions and safety requirements.

END OF SECTION 033616

DSECTION 042113 - BRICK MASONRY

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:

1. Face brick.
2. Thin-set brick veneer.
3. Mortar.
4. Ties and anchors.
5. Embedded flashing.
6. Miscellaneous masonry accessories.

- B. Related Sections:

1. Section 034100 – "Precast Structural Concrete" for thin brick veneer cast in precast concrete panels.
2. Section 055000 - "Metal Fabrications" for furnishing steel lintels and for brick masonry.

1.3 SUBMITTALS

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

- B. Shop Drawings: For the following:

1. Masonry Units: Show sizes, profiles, coursing, and locations of special shapes.
2. Fabricated Flashing: Detail corner units, end-dam units, and other special applications.

- C. Samples for Verification: For each type and color of the following:

1. Face brick, in the form of straps of five or more bricks.
2. Weep holes and vents.
3. Accessories embedded in masonry.

- D. List of Materials Used in Constructing Mockups: List generic product names together with manufacturers, manufacturers' product names, model numbers, lot numbers, batch numbers, source of supply, and other information as required to identify materials used. Include mix proportions for mortar and grout and source of aggregates.

1. Submittal is for information only. Neither receipt of list nor approval of mockup constitutes approval of deviations from the Contract Documents unless such deviations are specifically brought to the attention of Architect and approved in writing.
- E. Material Certificates: For each type and size of the following:
1. Masonry units.
 - a. Include data on material properties.
 - b. For brick, include size-variation data verifying that actual range of sizes falls within specified tolerances.
 - c. For exposed brick, include test report for efflorescence according to ASTM C 67.
 2. Cementitious materials. Include brand, type, and name of manufacturer.
 3. Preblended, dry mortar mixes. Include description of type and proportions of ingredients.
 4. Anchors, ties, and metal accessories.
- F. Cold-Weather and Hot-Weather Procedures: Detailed description of methods, materials, and equipment to be used to comply with requirements.
- G. Minutes from Pre-installation Conference.

1.4 QUALITY ASSURANCE

- A. Source Limitations for Masonry Units: Obtain exposed masonry units of a uniform texture and color, or a uniform blend within the ranges accepted for these characteristics, from single source from single manufacturer for each product required.
- B. Source Limitations for Mortar Materials: Obtain mortar ingredients of a uniform quality, including color for exposed masonry, from single manufacturer for each cementitious component and from single source or producer for each aggregate.
- C. Masonry Standard: Comply with ACI 530.1/ASCE 6/TMS 602 unless modified by requirements in the Contract Documents.
- D. Mockups: Build mockup to verify selections made under sample submittals and to demonstrate aesthetic effects and set quality standards for material and execution.
1. Build sample panels exposed brick masonry construction, stone band and both sizes and finishes of stone masonry in a panel size approximately 54-inches long by 60-inches high by full thickness, including face and backup wall construction and accessories.
 2. Include through-wall flashing.
 3. Include veneer anchors, insulation, flashing, cavity drainage material, and weep holes in exterior masonry- veneer wall mockup.
 4. Include CMU's on interior face of mockup.
 5. Include a sealant-filled joint at least 60-inches long in mockup.
 6. Clean exposed faces of panels with masonry cleaner indicated.

7. Protect approved sample panels from the elements with weather-resistant membrane.
8. Approval of sample panels is for color, texture, and blending of masonry units; relationship of mortar and sealant colors to masonry unit colors; tooling of joints; aesthetic qualities of workmanship; and other material and construction qualities specifically approved by Architect in writing.
 - a. Approval of sample panels does not constitute approval of deviations from the Contract Documents contained in sample panels unless such deviations are specifically approved by Architect in writing. Approval of mockups is also for other material and construction qualities specifically approved by Architect in writing.
9. Clean exposed faces of mockups with masonry cleaner as indicated.
10. Protect accepted mockups from the elements with weather-resistant membrane.
11. Approved mockups may not become part of the completed.

- E. Pre-installation Conference: Conduct conference at Project site to comply with requirements in Section 013113- "Project Coordination."

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Store masonry units on elevated platforms in a dry location. If units are not stored in an enclosed location, cover tops and sides of stacks with waterproof sheeting, securely tied. If units become wet, do not install until they are dry.
- B. Store cementitious materials on elevated platforms, under cover, and in a dry location. Do not use cementitious materials that have become damp.
- C. Store aggregates where grading and other required characteristics can be maintained and contamination avoided.
- D. Deliver preblended, dry mortar mix in moisture-resistant containers designed for use with dispensing silos. Store preblended, dry mortar mix in delivery containers on elevated platforms, under cover, and in a dry location or in covered weatherproof dispensing silos.
- E. Store masonry accessories, including metal items, to prevent corrosion and accumulation of dirt and oil.

1.6 PROJECT CONDITIONS

- A. Protection of Masonry: During construction, cover tops of walls, projections, and sills with waterproof sheeting at end of each day's work. Cover partially completed masonry when construction is not in progress.
 1. Extend cover a minimum of 24-inches down both sides of walls and hold cover securely in place.

2. Where one wythe of multiwythe masonry walls is completed in advance of other wythes, secure cover a minimum of 24-inches down face next to unconstructed wythe and hold cover in place.
- B. Stain Prevention: Prevent grout, mortar, and soil from staining the face of masonry to be left exposed or painted. Immediately remove grout, mortar, and soil that come in contact with such masonry.
1. Protect base of walls from rain-splashed mud and from mortar splatter by spreading coverings on ground and over wall surface.
 2. Protect sills, ledges, and projections from mortar droppings.
 3. Protect surfaces of window and door frames, as well as similar products with painted and integral finishes, from mortar droppings.
 4. Turn scaffold boards near the wall on edge at the end of each day to prevent rain from splashing mortar and dirt onto completed masonry.
- C. Cold-Weather Requirements: Do not use frozen materials or materials mixed or coated with ice or frost. Do not build on frozen substrates. Remove and replace unit masonry damaged by frost or by freezing conditions. Comply with cold-weather construction requirements contained in ACI 530.1/ASCE 6/TMS 602.
1. Cold-Weather Cleaning: Use liquid cleaning methods only when air temperature is 40 deg F and higher and will remain so until masonry has dried, but not less than seven days after completing cleaning.
- D. Hot-Weather Requirements: Comply with hot-weather construction requirements contained in ACI 530.1/ASCE 6/TMS 602.

PART 2 - PRODUCTS

2.1 MASONRY UNITS, GENERAL

- A. Defective Units: Referenced masonry unit standards may allow a certain percentage of units to contain chips, cracks, or other defects exceeding limits stated in the standard. Do not use units where such defects will be exposed in the completed Work.
- B. Fire-Resistance Ratings: Where indicated, provide units that comply with requirements for fire-resistance ratings indicated as determined by testing according to ASTM E 119, by equivalent masonry thickness, or by other means, as acceptable to authorities having jurisdiction.

2.2 BRICK

- A. General: Provide shapes indicated and as follows, with exposed surfaces matching finish and color of exposed faces of adjacent units.

1. For ends of sills and caps and for similar applications that would otherwise expose unfinished brick surfaces, provide units without cores or frogs and with exposed surfaces finished.
 2. Provide special shapes for applications where stretcher units cannot accommodate special conditions, including those at corners, movement joints, bond beams, sashes, and lintels.
 3. Provide special shapes for soldier course at corners.
- B. Face Brick Color A: Field facing brick complying with ASTM C 216.
1. Basis-of Design Product: Subject to compliance with requirements, provide "Coppertone Velour" as manufactured by Sioux City Brick or a comparable product by the following:
 - a. Endicott Clay Products.
 - b. Glen-Gery Brick
 - c. Interstate brick.
 - d. The Belden Brick Company.
 2. Size: Modular.
 3. Grade: SW.
 4. Type: FBX.
 5. Initial Rate of Absorption: Less than 30 g/30 sq. in. per minute when tested per ASTM C 67.
 6. Efflorescence: Provide brick that has been tested according to ASTM C 67 and is rated "not effloresced."
 7. Full Unit Size (Actual Dimensions): 3-5/8-inches wide by 3-5/8-nches high by 7-5/8-inches long.
 8. Thin-Set Unit Size: Size (Actual Dimensions): 3/4-inches wide by 3-5/8-nches high by 7-5/8- inches long.
- C. Face Brick Color B: Field facing brick complying with ASTM C 216.
1. Basis-of Design Product: Subject to compliance with requirements, provide "Sienna Ironspt Velour" as manufactured by Endicott Clay Products or a comparable product by the following:
 - a. Glen-Gery Brick
 - b. Interstate brick.
 - c. Sioux City Brick
 - d. The Belden Brick Company.
 2. Size: Modular.
 3. Grade: SW.
 4. Type: FBX.
 5. Initial Rate of Absorption: Less than 30 g/30 sq. in. per minute when tested per ASTM C 67.
 6. Efflorescence: Provide brick that has been tested according to ASTM C 67 and is rated "not effloresced."
 7. Size (Actual Dimensions): 3-5/8-inches wide by 3-5/8-nches high by 7-5/8- inches long.

D. Thin Brick:

1. Thin-Set Unit Size: Size (Actual Dimensions): 3/4-inches wide by 3-5/8-inches high by 7-5/8-inches long.
2. Size, color, texture: Match existing adjacent brickwork.
3. Special shapes: Include corners, edge corners, and end edge corners.
4. Dimensional Tolerances – measure in accordance with ASTM C67.
 - a. Thickness: Plus 0 in., minus 1/16 inch.
 - b. Face size: Plus 0 in., minus 1/16 in. for dimensions 8 inch or less.
 - c. Plus 0 in., minus 3/32 in. (+0, -2.4mm) for dimensions greater than 8 inch.
 - d. Warpage: not more than 1/16 in. (1.6mm) either concave or convex from a consistent plane.
 - e. Out of square: Plus or minus 1/16 inch.
 - f. Shape angle: Plus or minus 1 degree from specified angle.
5. Properties:
 - a. Breaking strength: Not less than 250 psi (1.7 MPa) tested in accordance with ASTM C67.
 - b. Cold water absorption: Maximum 6% at 24 hours tested in accordance with ASTM C67.
 - c. Efflorescence: Rated “not effloresced” when tested in accordance with ASTM C67
 - d. Freeze thaw resistance:
 - 1) Uncoated brick: No detectable deterioration (spalling, cracking, or breaking) after 300 cycles tested in accordance with ASTM C666, Method A or B on assembled specimens.
 - 2) Surface coloring: No observable difference in the applied finish when viewed at a distance of 20 ft after 50 cycles tested in accordance with ASTM C67. In addition, the brick shall undergo ASTM C666 test described above.
 - e. Pull-out strength: Not less than 150 psi (1.0 MPa) from base concrete before and after freeze thaw testing tested in accordance with specified modification to ASTM E488.
6. Chemical resistance: Rated “not affected” when tested with a 10% hydrochloric acid solution in accordance with ASTM C650.

2.3 MORTAR MATERIALS

- A. Portland Cement: ASTM C 150, Type I or II, except Type III may be used for cold-weather construction. Provide natural color as required to produce mortar color to match existing.
- B. Hydrated Lime: ASTM C 207, Type S.

- C. Aggregate for Mortar: ASTM C 144.
 - 1. For mortar that is exposed to view, use washed aggregate consisting of natural sand or crushed stone.
- D. Cold-Weather Admixture: No cold-weather admixtures shall be used.
- E. Water: Potable.

2.4 TIES AND ANCHORS

- A. Materials: Provide ties and anchors specified in this article that are made from materials that comply with 042200 – "Concrete Unit Masonry".

2.5 EMBEDDED FLASHING MATERIALS

- A. Metal Flashing: Provide metal flashing complying with SMACNA's "Architectural Sheet Metal Manual and Section 076200 - "Sheet Metal Flashing and Trim" and as follows:
 - 1. Stainless-Steel: ASTM A 240/A 240M, Type 304, 0.016-inch thick.
 - 2. Copper: ASTM B 370, Temper H00, cold-rolled copper sheet, 16-oz./sq. ft. weight or 0.0216-inch thick or ASTM B 370, Temper H01, high-yield copper sheet, 12-oz./sq. ft. weight or 0.0162-inch thick.
 - 3. Fabricate continuous flashings in sections 96-inches long minimum, but not exceeding 12 feet. Provide splice plates at joints of formed, smooth metal flashing.
 - 4. Fabricate through-wall metal flashing embedded in masonry from stainless-steel or copper, with ribs at 3-inch intervals along length of flashing to provide an integral mortar bond.
 - a. Products: Subject to compliance with requirements, provide one of the following:
 - 1) Cheney Flashing Company; Cheney Flashing (Dovetail) or Cheney 3-Way Flashing (Sawtooth).
 - 2) Keystone Flashing Company, Inc.; Keystone 3-Way Interlocking Thru-wall Flashing.
 - 5. Fabricate through-wall flashing with drip edge unless otherwise indicated. Fabricate by extending flashing 1/2-inch out from wall, with outer edge bent down 30 degrees and hemmed.
 - 6. Fabricate metal drip edges for ribbed metal flashing from plain metal flashing of same metal as ribbed flashing and extending at least 3-inches into wall with hemmed inner edge to receive ribbed flashing and form a hooked seam. Form hem on upper surface of metal so that completed seam will shed water.
 - 7. Metal Drip Edge: Fabricate from stainless-steel. Extend at least 3-inches into wall and 1/2-inch out from wall, with outer edge bent down 30 degrees and hemmed.
 - 8. Metal Expansion-Joint Strips: Fabricate from stainless-steel to shapes indicated.

B. Flexible Flashing: Use one of the following unless otherwise indicated:

1. Copper-Laminated Flashing: 5-oz./sq. ft. copper sheet bonded between 2 layers of glass-fiber cloth. Use only where flashing is fully concealed in masonry.
 - a. Products: Subject to compliance with requirements, provide one of the following:
 - 1) Advanced Building Products Inc.; Copper Fabric Flashing or Copper Sealtite 2000.
 - 2) Dayton Superior Corporation, Dur-O-Wal Division; Copper Fabric Thru-Wall Flashing.
 - 3) Hohmann & Barnard, Inc.; H & B C-Fab Flashing.
 - 4) Phoenix Building Products; Type FCC-Fabric Covered Copper.
 - 5) Sandell Manufacturing Co., Inc.; Copper Fabric Flashing.
 - 6) York Manufacturing, Inc.; Multi-Flash 500.
2. Asphalt-Coated Copper Flashing: 5-oz./sq. ft. copper sheet coated with flexible asphalt. Use only where flashing is fully concealed in masonry.
 - a. Products: Subject to compliance with requirements, provide one of the following:
 - 1) Advanced Building Products Inc.; Cop-R-Cote.
 - 2) Dayton Superior Corporation, Dur-O-Wal Division; Copper Coated Thru-Wall Flashing.
 - 3) Hohmann & Barnard, Inc.; H & B C-Coat Flashing.
 - 4) Phoenix Building Products; Type ACC-Asphalt Bituminous Coated.
 - 5) Sandell Manufacturing Co., Inc.; Coated Copper Flashing.

C. Application: Unless otherwise indicated, use the following:

1. Where flashing is indicated to receive counterflashing, use metal flashing.
2. Where flashing is indicated to be turned down at or beyond the wall face, use metal flashing.
3. Where flashing is fully concealed, use flexible flashing.

D. Solder and Sealants for Sheet Metal Flashings:

1. Solder for Stainless-steel: ASTM B 32, Grade Sn60, with acid flux of type recommended by stainless-steel sheet manufacturer.
2. Solder for Copper: ASTM B 32, Grade Sn50, 50 percent tin and 50 percent lead.
3. Elastomeric Sealant: ASTM C 920, chemically curing urethane or silicone sealant; of type, grade, class, and use classifications required to seal joints in sheet metal flashing and trim and remain watertight.

E. Adhesives, Primers, and Seam Tapes for Flashings: Flashing manufacturer's standard products or products recommended by flashing manufacturer for bonding flashing sheets to each other and to substrates.

2.6 MISCELLANEOUS MASONRY ACCESSORIES

- A. Bond-Breaker Strips: Asphalt-saturated, organic roofing felt complying with ASTM D 226, Type I (No. 15 asphalt felt).
- B. Weep/Vent Products: Use one of the following unless otherwise indicated:
 - 1. Cellular Plastic Weep/Vent: One-piece, flexible extrusion made from UV-resistant polypropylene copolymer, full height 3-5/8-inches and width of head joint and depth 1/8-inch less than depth of outer wythe, in color selected from manufacturer's standard.
 - a. Products: Subject to compliance with requirements, provide one of the following:
 - 1) Dayton Superior Corporation, Dur-O-Wal Division; Cell Vents.
 - 2) Heckmann Building Products Inc.; No. 85 Cell Vent.
 - 3) Hohmann & Barnard, Inc.; Quadro-Vent.
- C. Cavity Drainage Material: Free-draining mesh, made from polymer strands that will not degrade within the wall cavity.
 - 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Advanced Building Products Inc.; Mortar Break or Mortar Break II.
 - b. Archovations, Inc.; CavClear Masonry Mat.
 - c. Dayton Superior Corporation, Dur-O-Wal Division; Polytite MortarStop.
 - d. Mortar Net USA, Ltd.; Mortar Net.
 - 2. Provide one of the following configurations:
 - a. Strips, full-depth of cavity and 10-inches high, with dovetail shaped notches 7-inches deep that prevent clogging with mortar droppings.
 - b. Strips, not less than 1-1/2-inches thick and 10-inches high, with dimpled surface designed to catch mortar droppings and prevent weep holes from clogging with mortar.

2.7 MASONRY CLEANERS

- A. Proprietary Acidic Cleaner: Manufacturer's standard-strength cleaner designed for removing mortar/grout stains, efflorescence, and other new construction stains from new masonry without discoloring or damaging masonry surfaces. Use product expressly approved for intended use by cleaner manufacturer and manufacturer of masonry units being cleaned.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Diedrich Technologies, Inc.
 - b. EaCo Chem, Inc.
 - c. ProSoCo, Inc.

2.8 MORTAR MIXES

- A. General: Do not use admixtures, including pigments, air-entraining agents, accelerators, retarders, water-repellent agents, antifreeze compounds, or other admixtures unless otherwise indicated.
 - 1. Do not use calcium chloride in mortar.
 - 2. Use Portland cement-lime mortar unless otherwise indicated.
 - 3. No cold-weather admixtures allowed.
- B. Preblended, Dry Mortar Mix: Furnish dry mortar ingredients in form of a preblended mix. Measure quantities by weight to ensure accurate proportions, and thoroughly blend ingredients before delivering to Project site.
- C. Mortar for Unit Masonry: Comply with ASTM C 270, Proportion Specification. Provide Type S for exterior Brick construction.
 - 1. Pigments shall not exceed 5 percent of masonry cement or mortar cement by weight.
 - 2. Application: Use pigmented mortar for exposed mortar joints with the following units:
 - a. Face brick.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION, GENERAL

- A. Leave openings for equipment to be installed before completing masonry. After installing equipment, complete masonry to match the construction immediately adjacent to opening.
- B. Use full-size units without cutting if possible. If cutting is required to provide a continuous pattern or to fit adjoining construction, cut units with motor-driven saws; provide clean, sharp, unchipped edges. Allow units to dry before laying unless wetting of units is specified. Install cut units with cut surfaces and, where possible, cut edges concealed.
- C. Select and arrange units for exposed unit masonry to produce a uniform blend of colors and textures.
 - 1. Mix units from several pallets or cubes as they are placed.

- D. Wetting of Brick: Wet brick before laying if initial rate of absorption exceeds 30 g/30 sq. in. per minute when tested per ASTM C 67. Allow units to absorb water so they are damp but not wet at time of laying.

3.3 TOLERANCES

A. Dimensions and Locations of Elements:

1. For dimensions in cross section or elevation do not vary by more than plus 1/2-inch or minus 1/4-inch.
2. For location of elements in plan do not vary from that indicated by more than plus or minus 1/2-inch.
3. For location of elements in elevation do not vary from that indicated by more than plus or minus 1/4-inch in a story height or 1/2-inch total.

B. Lines and Levels:

1. For bed joints and top surfaces of bearing walls do not vary from level by more than 1/4-inch in 10 feet, or 1/2-inch maximum.
2. For conspicuous horizontal lines, such as lintels, sills, parapets, and reveals, do not vary from level by more than 1/8-inch in 10 feet, or 1/2-inch maximum.
3. For vertical lines and surfaces do not vary from plumb by more than 1/4-inch in 10 feet, or 1/2-inch maximum.
4. For conspicuous vertical lines, such as external corners, door jambs, reveals, and expansion and control joints, do not vary from plumb by more than 1/8-inch in 10 feet or 1/2-inch maximum.
5. For lines and surfaces do not vary from straight by more than 1/4-inch in 10 feet, or 1/2-inch maximum.
6. For vertical alignment of exposed head joints, do not vary from plumb by more than 1/4-inch in 10 feet, or 1/2-inch maximum.
7. For faces of adjacent exposed masonry units, do not vary from flush alignment by more than 1/16-inch except due to warpage of masonry units within tolerances specified for warpage of units.

C. Joints:

1. For bed joints, do not vary from thickness indicated by more than plus or minus 1/8-inch with a maximum thickness limited to 1/2-inch. Do not vary from bed-joint thickness of adjacent courses by more than 1/8-inch.
2. For exposed head joints, do not vary from thickness indicated by more than plus or minus 1/8-inch. Do not vary from adjacent bed-joint and head-joint thicknesses by more than 1/8-inch.

3.4 LAYING MASONRY WALLS

- A. Lay out walls in advance for accurate spacing of surface bond patterns with uniform joint thicknesses and for accurate location of openings, movement-type joints, returns, and offsets.

Avoid using less-than-half-size units, particularly at corners, jambs, and, where possible, at other locations.

- B. Bond Pattern for Exposed Masonry: Unless otherwise indicated, lay exposed masonry in running bond with rowlock (header) and soldier bands, as indicated on Drawings; do not use units with less than nominal 4-inch horizontal face dimensions at corners or jambs. Soldier corners are a special shape.
- C. Stopping and Resuming Work: Stop work by racking back units in each course from those in course below; do not tooth. When resuming work, clean masonry surfaces that are to receive mortar, remove loose masonry units and mortar, and wet brick if required before laying fresh masonry.
- D. Built-in Work: As construction progresses, build in items specified in this and other Sections. Fill in solidly with masonry around built-in items.
- E. Fill space between steel frames and masonry solidly with mortar unless otherwise indicated.

3.5 MORTAR BEDDING AND JOINTING

- A. Lay hollow brick as follows:
 - 1. With face shells fully bedded in mortar and with head joints of depth equal to bed joints.
 - 2. With entire units, including areas under cells, fully bedded in mortar at starting course on footings.
- B. Lay solid masonry units with completely filled bed and head joints; butter ends with sufficient mortar to fill head joints and shove into place. Do not deeply furrow bed joints or slush head joints.
- C. Set stone trim units in full bed of mortar with full vertical joints. Fill dowel, anchor, and similar holes.
 - 1. Clean soiled surfaces with fiber brush and soap powder and rinse thoroughly with clear water.
 - 2. Allow cleaned surfaces to dry before setting.
 - 3. Wet joint surfaces thoroughly before applying mortar.
- D. Tool exposed joints slightly concave when thumbprint hard, using a jointer larger than joint thickness unless otherwise indicated.

3.6 ANCHORING MASONRY VENEERS

- A. Anchor masonry veneers to masonry-veneer anchors to comply with the following requirements:

1. Locate anchor sections to allow maximum vertical differential movement of ties up and down.
2. Space anchors as indicated, but not more than 16-inches o.c. vertically and 24-inches o.c. horizontally with not less than 1 anchor for each 2.67 sq. ft. of wall area. Install additional anchors within 12-inches of openings and at intervals, not exceeding 36-inches, around perimeter.

3.7 EXPANSION JOINTS

- A. General: Install expansion joint materials in unit masonry as masonry progresses. Do not allow materials to span expansion joints without provision to allow for in-plane wall or partition movement.
- B. Form expansion joints in brick as follows:
 1. Build flanges of metal expansion strips into masonry. Lap each joint 4-inches in direction of water flow. Seal joints below grade and at junctures with horizontal expansion joints if any.
 2. Form open joint full depth of brick wythe and of width indicated, but not less than 3/8-inch for installation of sealant and backer rod specified in Section 079200 - "Joint Sealants."
- C. Provide horizontal, pressure-relieving joints by either leaving an airspace or inserting a compressible filler of width required for installing sealant and backer rod specified in Section 079200 "Joint Sealants," but not less than 3/8-inch.

3.8 LINTELS

- A. Install galvanized steel lintels as indicated.
- B. Provide minimum bearing of 8-inches at each jamb unless otherwise indicated.

3.9 FLASHING, WEEP HOLES, CAVITY DRAINAGE, AND VENTS

- A. General: Install embedded flashing and weep holes in masonry at shelf angles, lintels, ledges, other obstructions to downward flow of water in wall, and where indicated.
- B. Install flashing as follows unless otherwise indicated:
 1. Prepare masonry surfaces so they are smooth and free from projections that could puncture flashing. Where flashing is within mortar joint, place through-wall flashing on sloping bed of mortar and cover with mortar. Before covering with mortar, seal penetrations in flashing with adhesive, sealant, or tape as recommended by flashing manufacturer.

2. At masonry-veneer walls, extend flashing through veneer, across air space behind veneer, and up face of sheathing at least 8-inches, with upper edge tucked under building paper or building wrap, lapping at least 4-inches.
 3. At lintels and shelf angles, extend flashing a minimum of 6-inches to masonry at each end. At heads and sills, extend flashing 6-inches at ends and turn up not less than 2-inches to form end dams.
 4. Interlock end joints of ribbed sheet metal flashing by overlapping ribs not less than 1-1/2-inches or as recommended by flashing manufacturer, and seal lap with elastomeric sealant complying with requirements in Division 07 Section - "Joint Sealants" for application indicated.
 5. Install metal drip edges with ribbed sheet metal flashing by interlocking hemmed edges to form hooked seam. Seal seam with elastomeric sealant complying with requirements in Section 079200 - "Joint Sealants" for application indicated.
 6. Install metal drip edges beneath flexible flashing at exterior face of wall. Stop flexible flashing 1/2-inch back from outside face of wall and adhere flexible flashing to top of metal drip edge.
 7. Install metal flashing termination beneath flexible flashing at exterior face of wall. Stop flexible flashing 1/2-inch back from outside face of wall and adhere flexible flashing to top of metal flashing termination.
- C. Install reglets and nailers for flashing and other related construction where they are shown to be built into masonry.
- D. Install weep holes in head joints in exterior wythes of first course of masonry immediately above embedded flashing and as follows:
1. Use specified weep/vent products to form weep holes.
 2. Space weep holes 24-inches unless otherwise indicated.
 3. Trim wicking material flush with outside face of wall after mortar has set.
- E. Place cavity drainage material in cavities to comply with configuration requirements for cavity drainage material in "Miscellaneous Masonry Accessories" Article.

3.10 FIELD QUALITY CONTROL

- A. Testing and Inspecting: Engage special inspectors to perform tests and inspections and prepare reports. Allow inspectors access to scaffolding and work areas, as needed to perform tests and inspections. Retesting of materials that fail to meet specified requirements shall be done at Contractor's expense.
- B. Inspections: Level 2 special inspections according to the "International Building Code."
1. Begin masonry construction only after inspectors have verified proportions of site-prepared mortar.
- C. Mortar Aggregate Ratio Test (Proportion Specification): For each mix provided, according to ASTM C 780.

3.11 REPAIRING, POINTING, AND CLEANING

- A. Remove and replace masonry units that are loose, chipped, broken, stained, or otherwise damaged or that do not match adjoining units. Install new units to match adjoining units; install in fresh mortar, pointed to eliminate evidence of replacement.
- B. Pointing: During the tooling of joints, enlarge voids and holes, except weep holes, and completely fill with mortar. Point up joints, including corners, openings, and adjacent construction, to provide a neat, uniform appearance. Prepare joints for sealant application, where indicated.
- C. In-Progress Cleaning: Clean unit masonry as work progresses by dry brushing to remove mortar fins and smears before tooling joints.
- D. Final Cleaning: After mortar is thoroughly set and cured, clean exposed masonry as follows:
 - 1. Remove large mortar particles by hand with wooden paddles and nonmetallic scrape hoes or chisels.
 - 2. Test cleaning methods on sample wall panel; leave one-half of panel uncleaned for comparison purposes. Obtain Architect's approval of sample cleaning before proceeding with cleaning of masonry.
 - 3. Protect adjacent stone and non-masonry surfaces from contact with cleaner by covering them with liquid strippable masking agent or polyethylene film and waterproof tape.
 - 4. Clean masonry with a proprietary acidic cleaner applied according to manufacturer's written instructions.

3.12 MASONRY WASTE DISPOSAL

- A. Excess whole bricks shall become property of Owner. At completion of unit masonry work, store as directed on Owner's site.

END OF SECTION 042113

SECTION 071326 - SELF-ADHERING SHEET WATERPROOFING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:

- 1. Modified bituminous sheet waterproofing on all below grade walls at restroom areas under Control rooms and recessed slab at Master Control.

- B. Related Requirements:

- 1. Section 033000 – “Cast-In-Place Concrete” for foundation walls at restroom below Master Control.

1.3 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site.

- 1. Review waterproofing requirements including surface preparation, substrate condition and pretreatment, minimum curing period, forecasted weather conditions, special details and sheet flashings, installation procedures, testing and inspection procedures, and protection and repairs.

1.4 ACTION SUBMITTALS

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

- 1. Include construction details, material descriptions, and tested physical and performance properties of waterproofing.
 - 2. Include manufacturer's written instructions for evaluating, preparing, and treating substrate.

- B. Shop Drawings: Show locations and extent of waterproofing and details of substrate joints and cracks, expansion joints, sheet flashings, penetrations, inside and outside corners, tie-ins with adjoining waterproofing, and other termination conditions.

- 1. Include setting drawings showing layout, sizes, sections, profiles, and joint details of pedestal-supported concrete pavers.

- C. Samples: For each exposed product and for each color and texture specified, including the following products:

- 1. 8-by-8-inch square of waterproofing and flashing sheet.

1.5 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For Installer.
- B. Field quality-control reports.
- C. Sample Warranties: For special warranties.

1.6 QUALITY ASSURANCE

- A. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by waterproofing manufacturer.

1.7 FIELD CONDITIONS

- A. Environmental Limitations: Apply waterproofing within the range of ambient and substrate temperatures recommended in writing by waterproofing manufacturer. Do not apply waterproofing to a damp or wet substrate.
 - 1. Do not apply waterproofing in snow, rain, fog, or mist.
- B. Maintain adequate ventilation during preparation and application of waterproofing materials.

1.8 WARRANTY

- A. Manufacturer's Warranty: Manufacturer agrees to furnish replacement waterproofing material for waterproofing that does not comply with requirements or that fails to remain watertight within specified warranty period.
 - 1. Warranty Period: Five (5) years from date of Substantial Completion.
- B. Installer's Special Warranty: Specified form, signed by Installer, covering Work of this Section, for warranty period of two years.
- C. Source Limitations for Waterproofing System: Obtain waterproofing materials, protection course, and molded-sheet drainage panels from single source from single manufacturer.

PART 2 - PRODUCTS

2.1 MODIFIED BITUMINOUS SHEET WATERPROOFING

- A. Modified Bituminous Sheet: Minimum 60-mil nominal thickness ASTM D 3767, self-adhering sheet consisting of 56 mils of rubberized asphalt laminated on one side to a 4-mil-thick, polyethylene-film reinforcement, and with release liner on adhesive
1. Manufacturers: Subject to compliance with requirements, provide the following:
 - a. Carlisle Coatings & Waterproofing Inc; CCW MiraDRI 860/861.
 - b. Tremco Commercial Sealants and Waterproofing
 - c. Siplast
 - d. Soprema, Inc.
 - e. Protecto Wrap. Jiffy Seal 140/60.
 2. Physical Properties:
 - a. Tensile Strength, Membrane: 325 psi minimum; ASTM D 412, Die C, modified.
 - b. Ultimate Elongation: 350 percent minimum; ASTM D 412, Die C, modified.
 - c. Low-Temperature Flexibility: Pass at minus 40 deg FASTM D 1970/D 1970M.
 - d. Crack Cycling: Unaffected after 100 cycles of 1/8-inch movement; ASTM C 836/C 836M.
 - e. Puncture Resistance: 60 lbf minimum; ASTM E 154/E 154M.
 - f. Water Absorption: 0.1 percent weight-gain maximum after 48-hour immersion at 70 deg F; ASTM D 570.
 - g. Water Vapor Permeance: 0.05 perm maximum; ASTM E 96/E 96M, Water Method.
 - h. Hydrostatic-Head Resistance: 230 feet minimum; ASTM D 5385.
 - i. Tensile Strength, Film: 5000 psi, ASTM D 882.
 3. Sheet Strips: Self-adhering, rubberized-asphalt strips of same material and thickness as sheet waterproofing.

2.2 AUXILIARY MATERIALS

- A. Furnish auxiliary materials recommended by waterproofing manufacturer for intended use and compatible with sheet waterproofing.
1. Furnish liquid-type auxiliary materials that comply with VOC limits of authorities having jurisdiction.
- B. Primer: Liquid primer recommended for substrate by sheet-waterproofing material manufacturer.
- C. Surface Conditioner: Liquid, waterborne surface conditioner recommended for substrate by sheet-waterproofing material manufacturer.

- D. Liquid Membrane: Elastomeric, two-component liquid, cold fluid applied, of trowel grade or low viscosity.
- E. Substrate Patching Membrane: Low-viscosity, two-component, modified asphalt coating.
- F. Protection Course: Extruded-polystyrene foam insulation, ASTM C578, Type IV Standard Specification for Rigid Cellular Polystyrene Thermal Insulation.
 - 1. Basis-of-Design Product: Subject to compliance with requirements provide "Perimate" extruded polystyrene foam insulation as manufactured by Dow Chemical Co. or a comparable product by one of the following:
 - a. Johns Manville.
 - b. Owens Corning.
 - 2. Thickness: 2-inches.
 - 3. Thermal Resistance: R-10.
 - 4. Compressive Strength: ASTM D1621 30 psi.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements and other conditions affecting performance of waterproofing.
 - 1. Verify that concrete has cured and aged for minimum time period recommended in writing by waterproofing manufacturer.
 - 2. Verify that substrate is visibly dry and within the moisture limits recommended in writing by manufacturer. Test for capillary moisture by plastic sheet method according to ASTM D 4263.
 - 3. Verify that compacted subgrade is dry, smooth, sound, and ready to receive waterproofing sheet.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Clean, prepare, and treat substrates according to manufacturer's written instructions. Provide clean, dust-free, and dry substrates for waterproofing application.
- B. Mask off adjoining surfaces not receiving waterproofing to prevent spillage and overspray affecting other construction.
- C. Remove grease, oil, bitumen, form-release agents, paints, curing compounds, and other penetrating contaminants or film-forming coatings from concrete.

- D. Remove fins, ridges, mortar, and other projections and fill honeycomb, aggregate pockets, holes, and other voids.
- E. Prepare, fill, prime, and treat joints and cracks in substrates. Remove dust and dirt from joints and cracks according to ASTM D 4258.
- F. Bridge and cover isolation joints, expansion joints, and discontinuous deck-to-wall and deck-to-deck joints with overlapping sheet strips of widths according to manufacturer's written instructions.
 - 1. Invert and loosely lay first sheet strip over center of joint. Firmly adhere second sheet strip to first and overlap to substrate.
- G. Corners: Prepare, prime, and treat inside and outside corners according to ASTM D 6135.
 - 1. Install membrane strips centered over vertical inside corners. Install 3/4-inch fillets of membrane on horizontal inside corners and as follows:
 - a. At footing-to-wall intersections, extend membrane in each direction from corner or install membrane strip centered over corner.
- H. Prepare, treat, and seal vertical and horizontal surfaces at terminations and penetrations through waterproofing and at drains and protrusions according to ASTM D 6135.

3.3 MODIFIED BITUMINOUS SHEET-WATERPROOFING APPLICATION

- A. Install modified bituminous sheets according to waterproofing manufacturer's written instructions and per recommendations in ASTM D 6135.
- B. Apply primer to substrates at required rate and allow it to dry. Limit priming to areas that will be covered by sheet waterproofing in same day. Reprime areas exposed for more than 24 hours.
- C. Apply and firmly adhere sheets over area to receive waterproofing. Accurately align sheets and maintain uniform 2-1/2-inch minimum lap widths and end laps. Overlap and seal seams, and stagger end laps to ensure watertight installation.
 - 1. When ambient and substrate temperatures range between 25 and 40 deg F, install self-adhering, modified bituminous sheets produced for low-temperature application. Do not use low-temperature sheets if ambient or substrate temperature is higher than 60 deg F.
- D. Two-Ply Application: Install sheets to form a membrane with lap widths not less than 50 percent of sheet widths, to provide a minimum of two thicknesses of sheet membrane over areas to receive waterproofing.
- E. Horizontal Application: Apply sheets from low to high points of decks to ensure that laps shed water.

- F. Apply continuous sheets over already-installed sheet strips, bridging substrate cracks, construction, and contraction joints.
- G. Seal edges of sheet-waterproofing terminations with mastic.
- H. Install sheet-waterproofing and auxiliary materials to tie into adjacent waterproofing.
- I. Repair tears, voids, and lapped seams in waterproofing not complying with requirements. Slit and flatten fish mouths and blisters. Patch with sheet waterproofing extending 6-inches beyond repaired areas in all directions.
- J. Immediately install protection course with butted joints over waterproofing membrane.

3.4 FIELD QUALITY CONTROL

- A. Testing Agency: Owner will engage a qualified testing agency to perform tests.
- B. Manufacturer's Field Service: Engage a site representative qualified by waterproofing membrane manufacturer to inspect substrate conditions, surface preparation, membrane application, flashings, protection, and drainage components; and to furnish daily reports to Architect.
- C. Waterproofing will be considered defective if it does not pass tests and inspections.
- D. Prepare test and inspection reports.

3.5 PROTECTION, REPAIR, AND CLEANING

- A. Do not permit foot or vehicular traffic on unprotected membrane.
- B. Protect waterproofing from damage and wear during remainder of construction period.
- C. Protect installed insulation drainage panels from damage due to UV light, harmful weather exposures, physical abuse, and other causes. Provide temporary coverings where insulation is subject to abuse and cannot be concealed and protected by permanent construction immediately after installation.
- D. Correct deficiencies in or remove waterproofing that does not comply with requirements; repair substrates, reapply waterproofing, and repair sheet flashings.
- E. Clean spillage and soiling from adjacent construction using cleaning agents and procedures recommended in writing by manufacturer of affected construction.

END OF SECTION 071326

SECTION 074243- MODULAR METAL WALL, ROOF AND SOFITT PANELS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

- 1. Modular metal wall, roof and soffit panels over framed wall system and roof system.
- 2. Modular metal fascia and soffit panels over framed wall system at the main entrance canopy

B. Related Requirements:

- 1. Section 051200 – “Structural Steel Framing” for attaching and supporting panels to building structure.
- 2. Section 052100 – Steel Joist framing” for attaching and supporting panels to building structure.
- 3. Section 054000 - "Cold-Formed Metal Framing" for wall and soffit substrate framing.
- 4. Section 055000 – “Metal Fabrications” – for miscellaneous steel shapes for attaching and anchoring metal panels.
- 5. Section 061600 - "Sheathing" for exterior wall, roof and soffit sheathing.
- 6. Section 072100 – “Thermal Insulation” for wall and roof assembly insulation.
- 7. Section 075423 – “Thermoplastic Polyolefin (TPO) Roofing” – for roofing membrane system under the modular metal roof panels.
- 8. Section 076200 - “Sheet Metal Flashing and Trim” for sheet metal copings, flashings and reglets.
- 9. Section 0779200 - “Joint Sealants” for field-applied joint sealants.

1.3 REFERENCES

- A. ASTM E283-84, Test Method for Rate of Air Leakage Through Exterior Windows, Curtain Walls and Doors.
- B. ASTM E331-86, Test Method for Water Penetration of Exterior Windows, Curtain Walls, and Doors by Uniform Static Pressure Difference.
- C. ASTM E330, Structural Performance

1.4 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1. Meet with Owner, Architect, Owner's insurer if applicable, metal composite material panel Installer, metal composite material panel manufacturer's representative, structural-support Installer, and installers whose work interfaces with or affects metal composite material panels, including installers of storefront, entrance doors and curtain wall.
2. Review and finalize construction schedule and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delay
3. Review methods and procedures related to metal composite material panel installation, including manufacturer's written instructions.
4. Examine support conditions for compliance with requirements, including alignment between and attachment to structural members.
5. Review flashings, special siding details, wall penetrations, openings, and condition of other construction that affect metal composite material panels.
6. Review governing regulations and requirements for insurance, certificates, and tests and inspections if applicable.
7. Review temporary protection requirements for metal composite material panel assembly during and after installation.
8. Review procedures for repair of panels damaged after installation.
9. Document proceedings, including corrective measures and actions required, and furnish copy of record to each participant.

1.5 DESIGN CRITERIA

- A. The design, fabrication and erection of a complete aluminum building panel system is the responsibility of this subcontractor and is based on the performance criteria specified. The system shall be a dry joint system which shall incorporate a pressure equalized "rainscreen" system on a complete air and vapor seal, not only allowing air and vapor which enters the panel chamber to drain to the exterior of the wall, but will also allow air into the pressuring chamber to provide instantaneous pressure equalization. Vents and drain holes shall be inconspicuously located and in such positions as not to contribute to staining, streaking or marking of the panel face. Emphasis shall be placed upon the prime integrity of the critical inner air/vapor seal.
- B. Design and install specified Aluminum building panel system and all connections to withstand earthquake forces in accordance with the requirements of Governing Building Code.
- B. The specified Aluminum building panel assembly shall be designed to accommodate the structural inter-story drifts and other movements without breakage, dislodgment or connection failure.
- D. Wind and suction loads normal to the plane of the assembly shall be calculated in accordance with the Governing Building Code.

- E. Perimeter Framing Deflection: Deflection of panel perimeter framing member shall not exceed $L/175$ normal to plane of the wall where L is the unsupported span of the perimeter framing member
- F. Panel Deflection: Deflection of the panel face shall not exceed $L/60$ at design load where L is the unsupported span of the panel
- G. Provide for free noiseless thermal movement of components as may be caused by a temperature variation.
- H. Allow for movement in cladding caused by deflection in structure.
- I. Design wall system to allow for the unobstructed movement of air between the exterior and interior sides of metal cladding in accordance with industry accepted Rain Screen Principles.
- J. Ensure panel exhibits no permanent deformation when subject to design criteria specified.
- K. The system shall provide clear internal paths of drainage in order to drain any trapped moisture to the exterior, discharging moisture in a manner avoiding staining of architectural finishes, collecting in puddles, formation of unsafe icicles and dripping onto pedestrians.
- L. Fasten panel assembly to building structure in a manner which transmits all loads to the main structure without exceeding the capacity of any fastener.
- M. Individual panels shall be removable without disturbing adjacent panels.
- N. Panels shall not warp or buckle when under full design loads.
- O. All fastenings and connectors shall be concealed. Connection and attachment devices shall not cause staining to cladding or other adjoining materials. The anchorage system shall be designed so that the panels are secured yet "free-floating", to accommodate expansion and contraction.
- P. The system shall not incorporate sealant between panel joints.
- Q. Anchor assemblies or connection hardware, including all related connections, tracks, girts, fasteners, etc., for and related to the cladding panels shall be designed, engineered, furnished and installed as required in compliance with the specified design and performance criteria. All such items are schematic and do not necessarily indicate the exact required scope, type, shape or profile. Location and methods of anchoring panels shall be the subcontractor's responsibility, who shall design the cladding panels and connections to suit each specific condition in an acceptable manner complying with requirements specified.
- R. Panel system shall be in compliance with the Governing authorities having jurisdiction.
- S. Pressure Equalized Rainscreen System: Provide Systems that have been tested and passed in accordance with AAMA 508-7

1.6 ACTION SUBMITTALS

- A. Product Data: For each type of product.
 - 1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for each type of panel and accessory.
- B. Shop Drawings:
 - 1. Include fabrication and installation layouts of metal composite material panels; details of edge conditions, joints, panel profiles, corners, anchorages, attachment assembly, trim, flashings, closures, and accessories; and special details.
 - 2. Accessories: Include details of the flashing, trim and anchorage, at a scale of not less than 1-1/2-inches per 12-inches.
 - 3. Include all materials, recommendations and details describing the proposed use, design and erection procedures for all anchorage shall be documented and fully described on the shop drawings.
- D. Samples for Verification: For each type of exposed finish required, prepared on samples of size indicated below.
 - 1. Metal Composite Material Panels: Submit two (2) 24 by 24-inches finished sample of each finish selected by Architect. Include fasteners, closures, and other metal composite material panel accessories.

1.7 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For Installer.
- B. Product Test Reports: For each product, tests performed by a qualified testing agency.
- C. Field quality-control reports.
- D. Sample Warranties: For special warranties.

1.8 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For metal composite material panels to include in maintenance manuals.

1.9 QUALITY ASSURANCE

- A. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by manufacturer and shall have a minimum of five (5) years in on-site panel installation and proven experience in this type of work.

- B. Manufacturers Qualifications: Approved manufacturer listed in this Section with minimum ten (10) years experience in manufacturer of similar products in n similar applications.
- C. Mockups: Build mockups to verify selections made under Sample submittals and to demonstrate aesthetic effects and set quality standards for fabrication and installation.
 - 1. Build mockup of typical metal composite material panel assembly, including corner, soffits, supports, attachments, and accessories.
 - 2. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.

1.10 DELIVERY, STORAGE, AND HANDLING

- A. Deliver components, metal composite material panels, and other manufactured items so as not to be damaged or deformed. Package metal composite material panels for protection during transportation and handling.
- B. Unload, store, and erect metal composite material panels in a manner to prevent bending, warping, twisting, and surface damage.
- C. Stack metal composite material panels horizontally on platforms or pallets, covered with suitable weathertight and ventilated covering. Store metal composite material panels to ensure dryness, with positive slope for drainage of water. Do not store metal composite material panels in contact with other materials that might cause staining, denting, or another surface damage.
- D. Retain strippable protective covering on metal composite material panels during installation.

1.11 FIELD CONDITIONS

- A. Field Measurements: Panel installer's responsibility to verify locations of structural members, adjoining construction and wall openings dimensions by field measurement before panel fabrication and indicate measurements on final shop drawings.
- B. Weather Limitations: Proceed with installation only when existing and forecasted weather conditions permit assembly of metal composite material panels to be performed according to manufacturers' written instructions and warranty requirements.

1.12 COORDINATION

- A. Coordinate metal composite material panel installation with rain drainage work, flashing, trim, construction of soffits, and other adjoining work to provide a leakproof, secure, and noncorrosive installation.

1.13 WARRANTY

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of metal composite material panel systems that fail in materials or workmanship within specified warranty period.
 - 1. Failures include, but are not limited to, the following:
 - a. Structural failures including rupturing, cracking, or puncturing.
 - b. Deterioration of metals and other materials beyond normal weathering.
 - c. Warranty Period: Two (2) years from date of Substantial Completion.
- D. Special Warranty on Panel Finishes: Manufacturer's standard form in which manufacturer agrees to repair finish or replace metal composite material panels that show evidence of deterioration of factory-applied finishes within specified warranty period.
 - 1. Deterioration includes, but is not limited to, the following:
 - a. Color fading more than 5 Hunter units when tested according to ASTM D 2244.
 - b. Chalking in excess of a No. 8 rating when tested according to ASTM D 4214.
 - c. Cracking, checking, peeling, or failure of paint to adhere to bare metal.
 - 2. Finish Warranty Period: Twenty (20) years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Structural Performance: Provide metal composite material panel systems capable of withstanding the effects of the following loads, based on testing according to ASTM E 330:
 - 1. Wind Loads: As indicated on Drawings.
 - 2. Other Design Loads: As indicated on Drawings.
 - 3. Deflection Limits: For wind loads, no greater than 1/180 of the span.
- B. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes by preventing buckling, opening of joints, overstressing of components, failure of joint sealants, failure of connections, and other detrimental effects. Base calculations on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.
 - 1. Temperature Change (Range): 120 deg F, ambient; 180 deg F, material surfaces.

2.2 ALUMINUM PLATE MATERIAL WALL, ROOF AND SOFFIT PANELS

- A. Metal Wall Panel Systems: Provide factory-formed and -assembled, metal wall and soffit panels fabricated from single skin aluminum plate; formed into profile for installation method indicated. Include attachment assembly components, panel stiffeners, and accessories required for rainscreen system.
1. Basis-of-Design Product: Subject to compliance with requirements provide "SL 2000P" aluminum panel as manufactured by Sobotec Ltd. or a comparable product by one of the following:
 - a. Centria.
 - b. Firestone Building Products
 - c. Keith Panels, Inc.
 - d. Pohl, Inc.
 - e. Castle Metal Products.
- B. Aluminum Wall, Roof and Soffit Panels: Factory-formed, aluminum dry-joint rain screen panels.
1. Panel joints: Extruded aluminum perimeter frame
 2. Extrusion Finish: Shall be mill finish aluminum on concealed side.
 3. Panel Clips: As recommended by manufacturer.
 4. Subgirts: Minimum .050-inch Z275 galvanized steel as per manufacturer's requirements for panel attachment system.
 5. Panel Thickness: 3MM (.125)
 6. Panel Size Limitations: 5 ft. by 5 ft. square or 5 ft. by 12 ft. maximum.
 7. Exterior Finish: Two-coat fluoropolymer system; 0.2-mil primer with 0.8-mil 70 percent PVDF fluoropolymer color coat AAMA 620.
 - a. Color: As selected by the Architect from manufacturer's standard colors.
 8. Unexposed Finish: Manufacture's standard nominal 0.5-mil nominal DFT backer coating.
 9. Exposed Trim, flashings and Fastener Finish: Match panel finish.
 - a. Thickness: 0.040-inch nominal.
 - b. Refer to Section 076200 "Sheet Metal Flashing and Trim".

2.3 SUPPORT MEMBERS, FASTENERS, CONNECTORS

- A. Type, size quantity and spacing of all connectors, supporting track, girts, fasteners and other hardware and anchorage devices for panels as required to suit specified standards.
- B. Fastening devices between aluminum or aluminum and other materials shall be aluminum or stainless steel that will not permit staining.
- C. Self-locking fasteners shall be stainless steel with nylon inserts or patches.
- D. Shims shall be metal to match adjacent surfaces. Do not use plastic shims.

2.4 FLASHING AND TRIM

- A. Provide custom factory-fabricated integral companion flashing, trims, end caps and finishing components from same material as the aluminum building panels.
- B. Finish: Shall be of matching color with the Aluminum building panels.
- C. Flashing and Trims: Prefinished in accordance with Section 076200 – “Sheet Metal Flashing and Trim”.
- D. Color: As selected by the Architect from manufacturer’s standard colors.

2.5 MATERIALS

- A. Aluminum Sheet: Smooth surface coil-coated sheet, ASTM B209, 3105-H14 Alloy.
 - 1. Aluminum Material: Tension-leveled.
 - 2. Thickness: 0.040-inch nominal.
- B. Aluminum Extrusions: ASTM B 221, 3105 Aluminum.

2.6 SECONDARY METAL FRAMING (if required)

- A. Miscellaneous Framing Components, General: Cold-formed metallic-coated steel sheet, ASTM C645, Grade 50 with ASTM A 653/A 653M, G90 (Z180) hot-dipped galvanized zinc coating.
 - 1. Hat Channels: 0.0451-inch (16 gage) minimum.
 - 2. Sill Channels: 0.0451-inch (16 gage) minimum.

2.7 MISCELLANEOUS MATERIALS

- A. Panel Accessories: Provide components required for a complete, weathertight panel system including trim, copings, fasciae, mullions, sills, corner units, clips, flashings, sealants, gaskets, fillers, closure strips, and similar items. Match material and finish of metal composite material panels unless otherwise indicated.
- B. Extruded Trim: Aluminum, minimum thickness 0.060-inch for trim and .090-inch for structural units. Include manufacturer provided extruded trim for the following locations and as indicated on the Drawings:
 - 1. Base trim.
 - 2. Coping.
 - 3. Panel installation perimeter.
 - 4. Opening perimeters.
- C. Flashing and Trim: Provide flashing and trim formed from same material as metal composite material panels as required to seal against weather and to provide finished appearance.

- D. Locations include, but are not limited to, bases, drips, sills, jambs, corners, endwalls, framed openings, rakes, fascia, parapet caps, soffits, reveals, and fillers. Finish flashing and trim with same finish system as adjacent metal composite material panels.
- E. Splines: Match panel material and finish.
- F. Panel Fasteners: Self-tapping screws designed to withstand design loads. Provide exposed fasteners with heads matching color of metal composite material panels by means of plastic caps or factory-applied coating. Provide EPDM or PVC sealing washers for exposed fasteners.
- G. Panel Sealants: ASTM C 920; elastomeric polyurethane or silicone sealant; of type, grade, class, and use classifications required to seal joints in metal composite material panels and remain weathertight; and as recommended in writing by metal composite material panel manufacturer.

2.8 ALUMINUM METAL PANEL FABRICATION

- A. General: Fabricate and finish metal composite material panels and accessories at the factory, by manufacturer's standard procedures and processes, as necessary to fulfill indicated performance requirements demonstrated by laboratory testing. Comply with indicated profiles and with dimensional and structural requirements.
- B. Machine fabricated all material in accordance with reviewed shop drawings with straight lines, square corners or smooth bends, free from twists, kinks, warps, dents, and other imperfections which may affect appearance or serviceability.
- C. Provide reinforced panels as required to meet the tolerances specified above.
- D. System shall have a flush appearance from the exterior with no reveal other than module joint width.
- E. Panels shall be aligned with no lap or reveal other than joint width to permit expansion and contraction.
- F. Thickness of the metal and details of assembly and support shall provide sufficient strength and stiffness to resist distortion of finish surface. Exposed edges and ends of metal shall be dressed smooth, free from sharp edges and with no uniform minimum radius corners. Connections and joints exposed to weather shall be constructed to exclude water.
- G. Fasteners shall be concealed.
- H. All necessary holes shall be drilled with clip attachments applied before application of finish.
- I. Trim and flashing shall be factory-fabricated ready for assembly.
- J. Design and fabricate appropriate type, size, quantity and spacing of all sub-connectors, girts, fasteners and other anchorage devices as required to suit the specified standards.

- K. Subgirts may require perforations at regular intervals to permit drainage of cavity.

2.9 FINISHES

- A. Protect mechanical and painted finishes on exposed surfaces from damage by applying strippable, temporary protective covering before shipping.
- B. Appearance of Finished Work: Variations in appearance of abutting or adjacent pieces are acceptable if they are within one-half of the range of approved Samples. Noticeable variations in same piece are not acceptable. Variations in appearance of other components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.
- C. Aluminum Panels and Accessories:
 - 1. Two-Coat Fluoropolymer: AAMA 2605. Fluoropolymer finish containing not less than 70 percent PVDF resin by weight in color coat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.

2.10 SEALANT

- A. Silicone Sealant: In accordance with Section 079200 – “Sealants”.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances, metal composite material panel supports, and other conditions affecting performance of the Work.
 - 1. Examine wall framing to verify that girts, angles, channels, studs, and other structural panel support members and anchorage have been installed within alignment tolerances required by metal composite material wall panel manufacturer.
 - 2. Examine wall sheathing to verify that sheathing joints are supported by framing or blocking and that installation is within flatness tolerances required by metal composite material wall panel manufacturer.
 - a. Verify that air or water-resistive barriers have been installed over sheathing or backing substrate to prevent air infiltration or water penetration.
- B. Examine roughing-in for components and assemblies penetrating metal composite material panels to verify actual locations of penetrations relative to seam locations of metal composite material panels before installation.

- C. Maximum deviations acceptable to modular metal panel system manufacturer:
 - 1. 1/4-inch in 20 feet vertically or horizontally from face plane of framing.
 - 2. 1/2-inch maximum deviation from flat substrate on any building elevation.
 - 3. 1/8-inch in 5 feet.
- D. Confirm presence of acceptable framing members to match installation requirements of modular metal panel system.
 - 1. Confirm framing minimum .0451-inch/18 gage at maximum 24-inch spacing.
- E. Verify that storefront, entrance doors and curtain wall and or other penetrations match layout on shop drawings.
- F. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Miscellaneous Supports: Install subframing, furring, and other miscellaneous panel support members and anchorages according to ASTM C 754 and metal composite material panel manufacturer's written recommendations.
 - 1. Soffit Framing: Wire tie or clip furring channels to supports, as required to comply with requirements for assemblies indicated.

3.3 ALUMINUM PANEL INSTALLATION

- A. General: Install metal composite material panels according to manufacturer's written instructions in orientation, sizes, and locations indicated on Drawings. Install panels perpendicular to supports unless otherwise indicated. Anchor metal composite material panels and other components of the Work securely in place, with provisions for thermal and structural movement.
 - 1. Shim or otherwise plumb substrates receiving metal composite material panels.
 - 2. Flash and seal metal composite material panels at perimeter of all openings. Fasten with self-tapping screws. Do not begin installation until air or water-resistive barriers and flashings that will be concealed by metal composite material panels are installed.
 - 3. Install screw fasteners in predrilled holes.
 - 4. Locate and space fastenings in uniform vertical and horizontal alignment.
 - 5. Install flashing and trim as metal composite material panel work proceeds.
 - 6. Locate panel splices over, but not attached to, structural supports. Stagger panel splices and end laps to avoid a four-panel lap splice condition.
 - 7. Align bottoms of metal composite material panels and fasten with blind rivets, bolts, or self-tapping screws. Fasten flashings and trim around openings and similar elements with self-tapping screws.
 - 8. Provide weathertight escutcheons for pipe- and conduit-penetrating panels.

- B. Fasteners:
 - 1. Aluminum Panels: All fasteners exposed to the exterior to be concealed.
- C. Metal Protection: Where dissimilar metals contact each other or corrosive substrates, protect against galvanic action as recommended in writing by metal composite material panel manufacturer.
- D. Attachment Assembly, General: Install attachment assembly required to support metal composite material wall panels and to provide a complete weathertight wall system, including subgirts, perimeter extrusions, tracks, drainage channels, panel clips, and anchor channels.
 - 1. Include attachment to supports, panel-to-panel joinery, panel-to-dissimilar-material joinery, and panel-system joint seals.
- E. Installation: Attach metal composite material wall panels to supports at locations, spacings, and with fasteners recommended by manufacturer to achieve performance requirements specified.
 - 1. Horizontal Joinery: Working from base of installation to top, connect upper panel to lower panel at dry seal joinery utilizing field-applied attachment clip.
 - 2. Vertical Joinery: Provide reveal between vertical ends of panels as shown on shop drawings using hardware furnished by manufacturer.
 - a. Install splines where indicated on drawings.
 - 3. Galvanic Action: Where elements of metal composite wall system will come into contact with dissimilar materials, treat faces and edges in contact with dissimilar materials as recommended by manufacturer.
- F. Accessory Installation: Install accessories with positive anchorage to building and weathertight mounting and provide for thermal expansion. Coordinate installation with flashings and other components.
 - 1. Install components required for a complete metal composite material panel assembly including trim, copings, corners, seam covers, flashings, sealants, gaskets, fillers, closure strips, and similar items. Provide types indicated by metal composite material panel manufacturer; or, if not indicated, provide types recommended in writing by metal composite material panel manufacturer.
- G. Flashing and Trim: Comply with performance requirements, manufacturer's written installation instructions, and SMACNA's "Architectural Sheet Metal Manual." Provide concealed fasteners where possible and set units true to line and level as indicated. Install work with laps, joints, and seams that are permanently watertight.
 - 1. Install exposed flashing and trim that is without buckling and tool marks and that is true to line and levels indicated, with exposed edges folded back to form hems. Install sheet metal flashing and trim to fit substrates and to result in waterproof performance.

2. Expansion Provisions: Provide for thermal expansion of exposed flashing and trim. Space movement joints at a maximum of 10 feet with no joints allowed within 24-inches of corner or intersection. Where lapped expansion provisions cannot be used, or would not be sufficiently waterproof, form expansion joints of intermeshing hooked flanges, not less than 1-inch deep, filled with mastic sealant (concealed within joints).

3.4 ERECTION TOLERANCES

- A. Installation Tolerances: Shim and align metal composite material wall panel units within installed tolerance of 1/4-inch in 20 feet, non-accumulative, on level, plumb, and location lines as indicated, and within 1/8-inch offset of adjoining faces and of alignment of matching profiles.

3.5 FIELD QUALITY CONTROL

- A. Testing Agency: Owner will engage a qualified independent testing agency to perform field tests and inspections.
- B. Water-Spray Test: After installation, test area of assembly for water penetration according to AAMA 501.2.
- C. Manufacturer's Field Service: Engage a factory-authorized service representative to test and inspect completed metal composite material wall panel installation, including accessories.
- D. Metal composite material wall panels will be considered defective if they do not pass test and inspections.
- E. Additional tests and inspections, at Contractor's expense, are performed to determine compliance of replaced or additional work with specified requirements.
- F. Prepare test and inspection reports.

3.6 CLEANING AND PROTECTION

- A. Remove temporary protective coverings and strippable films, if any, as metal composite material panels are installed, unless otherwise indicated in manufacturer's written installation instructions. On completion of metal composite material panel installation, clean finished surfaces as recommended by metal composite material panel manufacturer. Maintain in a clean condition during construction.
- B. After metal composite material panel installation, clear weep holes and drainage channels of obstructions, dirt, and sealant.

- C. Replace metal composite material panels that have been damaged or have deteriorated beyond successful repair by finish touchup or similar minor repair procedures per Architect's instruction.

END OF SECTION 074243

SECTION 075423 - THERMOPLASTIC POLYOLEFIN (TPO) ROOFING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Fully adhered thermoplastic polyolefin (TPO) roofing system.
2. Vapor retarder.
3. Roof insulation.
4. Cover board.
5. Walkways.

B. Related Requirements:

1. Section 061053 "Miscellaneous Rough Carpentry" for wood nailers, curbs, and blocking; and for wood-based, structural-use roof deck panels.
2. Section 077100 "Roof Specialties" for manufactured copings and roof edge flashings.
3. Section 079200 "Joint Sealants" for joint sealants, joint fillers, and joint preparation.

1.3 DEFINITIONS

- A. Roofing Terminology: Definitions in ASTM D 1079 and glossary in NRCA's "The NRCA Roofing Manual: Membrane Roof Systems" apply to Work of this Section.

1.4 PREINSTALLATION MEETINGS

A. Preinstallation Roofing Conference: Conduct conference at Project site.

1. Meet with Owner, Architect, Owner's insurer if applicable, testing and inspecting agency representative, roofing Installer, roofing system manufacturer's representative, deck Installer, air barrier Installer, and installers whose work interfaces with or affects roofing, including installers of roof accessories and roof-mounted equipment.
2. Review methods and procedures related to roofing installation, including manufacturer's written instructions.
3. Review and finalize construction schedule, and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.

4. Examine deck substrate conditions and finishes for compliance with requirements, including flatness and fastening.
5. Review structural loading limitations of roof deck during and after roofing.
6. Review base flashings, special roofing details, roof drainage, roof penetrations, equipment curbs, and condition of other construction that affects roofing system.
7. Review governing regulations and requirements for insurance and certificates if applicable.
8. Review temporary protection requirements for roofing system during and after installation.
9. Review roof observation and repair procedures after roofing installation.

1.5 ACTION SUBMITTALS

- A. Product Data: For each type of product.
 1. For insulation and roof system component fasteners, include copy of FM Approvals' RoofNav listing.
- B. Shop Drawings: Include roof plans, sections, details, and attachments to other work, including the following:
 1. Layout and thickness of insulation.
 2. Base flashings and membrane termination details.
 3. Flashing details at penetrations.
 4. Tapered insulation layout, thickness, and slopes.
 5. Roof plan showing orientation of steel roof deck and orientation of roof membrane, fastening spacings, and patterns for mechanically fastened roofing system.
 6. Insulation fastening patterns for corner, perimeter, and field-of-roof locations.
 7. Tie-in with adjoining air barrier.
- C. Samples for Verification: For the following products:
 1. Roof membrane and flashings.
 2. Walkway pads and rolls.
- D. Wind Uplift Resistance Submittal: For roofing system, indicating compliance with wind uplift performance requirements.

1.6 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For Installer manufacturer and testing agency.
- B. Manufacturer Certificates:
 1. Performance Requirement Certificate: Signed by roof membrane manufacturer, certifying that roofing system complies with requirements specified in "Performance Requirements" Article.

- a. Submit evidence of compliance with performance requirements.
- 2. Special Warranty Certificate: Signed by roof membrane manufacturer, certifying that all materials supplied under this Section are acceptable for special warranty.
- C. Product Test Reports: For roof membrane and insulation, for tests performed by a qualified testing agency, indicating compliance with specified requirements.
- D. Evaluation Reports: For components of roofing system, from ICC-ES.
- E. Field Test Reports:
 - 1. Fastener-pullout test results and manufacturer's revised requirements for fastener patterns.
- F. Field quality-control reports.
- G. Sample Warranties: For manufacturer's special warranties.

1.7 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For roofing system to include in maintenance manuals.

1.8 QUALITY ASSURANCE

- A. Manufacturer Qualifications: A qualified manufacturer that is UL listed for roofing system identical to that used for this Project.
- B. Installer Qualifications: A qualified firm that is approved, authorized, or licensed by roofing system manufacturer to install manufacturer's product and that is eligible to receive manufacturer's special warranty.

1.9 DELIVERY, STORAGE, AND HANDLING

- A. Deliver roofing materials to Project site in original containers with seals unbroken and labeled with manufacturer's name, product brand name and type, date of manufacture, approval or listing agency markings, and directions for storing and mixing with other components.
- B. Store liquid materials in their original undamaged containers in a clean, dry, protected location and within the temperature range required by roofing system manufacturer. Protect stored liquid material from direct sunlight.
 - 1. Discard and legally dispose of liquid material that cannot be applied within its stated shelf life.

- C. Protect roof insulation materials from physical damage and from deterioration by sunlight, moisture, soiling, and other sources. Store in a dry location. Comply with insulation manufacturer's written instructions for handling, storing, and protecting during installation.
- D. Handle and store roofing materials, and place equipment in a manner to avoid permanent deflection of deck.

1.10 FIELD CONDITIONS

- A. Weather Limitations: Proceed with installation only when existing and forecasted weather conditions permit roofing system to be installed according to manufacturer's written instructions and warranty requirements.

1.11 WARRANTY

- A. Special Warranty: Manufacturer agrees to repair or replace components of roofing system that fail in materials or workmanship within specified warranty period.
 - 1. Special warranty includes roof membrane, base flashings, roof insulation, fasteners, cover boards, vapor retarder, substrate board, and other components of roofing system.
 - 2. Warranty Period: Thirty (30) years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. General Performance: Installed roofing system and flashings shall withstand specified uplift pressures, thermally induced movement, and exposure to weather without failure due to defective manufacture, fabrication, installation, or other defects in construction. Roof system and flashings shall remain watertight.
 - 1. Accelerated Weathering: Roof membrane shall withstand 2000 hours of exposure when tested according to ASTM G 152, ASTM G 154, or ASTM G 155.
 - 2. Impact Resistance: Roof membrane shall resist impact damage when tested according to ASTM D 3746, ASTM D 4272, or the "Resistance to Foot Traffic Test" in FM Approvals 4470.
- B. Material Compatibility: Roofing materials shall be compatible with one another and adjacent materials under conditions of service and application required, as demonstrated by roof membrane manufacturer based on testing and field experience.
- C. Wind Uplift Resistance: Design roofing system to resist the following wind uplift pressures when tested according to FM Approvals 4474, UL 580, or UL 1897:
 - 1. Zone 1 (Roof Area Field): 60 psf.
 - 2. Zone 2 (Roof Area Perimeter): 90 psf.

3. Zone 3 (Roof Area Corners): 120 psf.

- D. FM Approvals' RoofNav Listing: Roof membrane, base flashings, and component materials shall comply with requirements in FM Approvals 4450 or FM Approvals 4470 as part of a roofing system, and shall be listed in FM Approvals' RoofNav for Class 1 or noncombustible construction, as applicable. Identify materials with FM Approvals Certification markings.
1. Fire/Windstorm Classification: Class 1A-90.
 2. Hail-Resistance Rating: SH.
- E. Exterior Fire-Test Exposure: ASTM E 108 or UL 790, Class A; for application and roof slopes indicated; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
- F. Fire-Resistance Ratings: Comply with fire-resistance-rated assembly designs indicated. Identify products with appropriate markings of applicable testing agency.

2.2 THERMOPLASTIC POLYOLEFIN (TPO) ROOFING

- A. TPO Sheet: ASTM D 6878/D 6878M, internally fabric- or scrim-reinforced, TPO sheet.
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Carlisle SynTec Incorporated.
 - b. Firestone Building Products.
 - c. GAF.
 - d. Johns Manville; a Berkshire Hathaway Company.
 2. Source Limitations: Obtain components for roofing system from manufacturers approved by roof membrane manufacturer.
 3. Thickness: 60 mils, nominal.
 4. Exposed Face Color: White.

2.3 AUXILIARY ROOFING MATERIALS

- A. General: Auxiliary materials recommended by roofing system manufacturer for intended use and compatible with other roofing components.
1. Adhesive and Sealants: Comply with VOC limits of authorities having jurisdiction.
- B. Sheet Flashing: Manufacturer's standard unreinforced TPO sheet flashing, 55 mils thick, minimum, of same color as TPO sheet.
- C. Prefabricated Pipe Flashings: As recommended by roof membrane manufacturer.
- D. Roof Vents: As recommended by roof membrane manufacturer.

1. Size: Not less than 4-inch diameter.
- E. Bonding Adhesive: Manufacturer's standard.
- F. Metal Termination Bars: Manufacturer's standard, predrilled stainless steel or aluminum bars, approximately 1 by 1/8-inch thick; with anchors.
- G. Fasteners: Factory-coated steel fasteners and metal or plastic plates complying with corrosion-resistance provisions in FM Approvals 4470, designed for fastening roofing components to substrate, and acceptable to roofing system manufacturer.
- H. Miscellaneous Accessories: Provide pourable sealers, preformed cone and vent sheet flashings, preformed inside and outside corner sheet flashings, T-joint covers, lap sealants, termination reglets, and other accessories.

2.4 VAPOR RETARDER

- A. Non-Asphaltic Laminated Sheet: Three-ply laminate combining two-layers of high-density polyethylene and a high strength core grid.
1. Basis-of-Design Product: Subject to compliance provide "Griffolyn Type-65" three-ply laminate as manufactured by Reef Industries, Inc. or a comparable product.
 2. Tape: Pressure-sensitive tape of type recommended by vapor retarder manufacturer for sealing joints and penetrations in vapor retarder.
 3. Weight: ASTM D 3776: 37 lb/1,000 ft² (18.1 kg/100 m²).
- B. Laminated Sheet: Polyethylene laminate, two layers, reinforced with cord grid, with maximum permeance rating of 0.62 perm.
1. Basis-of-Design Product: Subject to compliance provide "JM Vapor Barrier SA" three-ply laminate as manufactured by Johns Manville or a comparable product.
 2. Air/Vapor Barrier - a 40-mil composite consisting of 35-mils of self-adhering rubberized asphalt laminated to a 5-mil woven polypropylene film.
 3. Tape: Pressure-sensitive tape of type recommended by vapor retarder manufacturer for sealing joints and penetrations in vapor retarder.

2.5 ROOF INSULATION

- A. General: Preformed roof insulation boards manufactured or approved by TPO roof membrane manufacturer.
- B. Polyisocyanurate Board Insulation: ASTM C 1289, Type II, Class 1, Grade 2, felt or glass-fiber mat facer on both major surfaces.
1. Compressive Strength: 20 psi.
 2. Size: Manufacturers standard.

C. Tapered Insulation: Provide factory-tapered insulation boards.

1. Material: Match roof insulation.
2. Minimum Thickness: 1/4-inch.
3. Slope:
 - a. Roof Field: 1/4-inch per foot unless otherwise indicated on Drawings.
 - b. Saddles and Crickets: 1/2-inch per foot unless otherwise indicated on Drawings.
4. Minimum thickness at drains: 3-inches.

2.6 INSULATION ACCESSORIES

- A. General: Roof insulation accessories recommended by insulation manufacturer for intended use and compatibility with other roofing system components.
- B. Fasteners: Factory-coated steel fasteners with metal or plastic plates complying with corrosion-resistance provisions in FM Approvals 4470, designed for fastening roof insulation and cover boards to substrate, and acceptable to roofing system manufacturer.
 1. Exposed Fasteners: Cut length of visible fasteners prior to installing gypsum board ceiling in Vestibule B1000 and Lobby B1001 and also at exposed metal deck soffits at exterior canopies.
- C. Insulation Adhesive: Insulation manufacturer's recommended adhesive formulated to attach roof insulation to substrate or to another insulation layer as follows:
 1. Modified asphaltic, asbestos-free, cold-applied adhesive.
 2. Bead-applied, low-rise, one-component or multicomponent urethane adhesive.
 3. Full-spread, spray-applied, low-rise, two-component urethane adhesive.
- D. Cover Board: ASTM C 1177/C 1177M, glass-mat, water-resistant gypsum board or ASTM C 1278/C 1278M fiber-reinforced gypsum board.
 1. Thickness: 1/2-inch.
 2. Surface Finish: Unprimed.

2.7 TPO WALKWAY PADS

- A. Flexible Walkways: Factory-formed, nonporous, heavy-duty, slip-resisting, surface-textured walkway pads or rolls, approximately 0.156-inch thick and acceptable to roofing system manufacturer.
 1. Size: 30-inches wide continuous roll at metal roof and TPO roof transition for protection from falling water and snow onto the TPO membrane.
 2. Color: White.

- B. Molded EPDM Walkway Pads: Factory-formed, nonporous, heavy-duty, slip-resisting, surface-textured walkway pads approximately 0.375-inches thick and acceptable to roofing system manufacturer.
 - 1. Size: 30-inches by 30-inches long.
 - 2. Location: Refer to drawings.
 - 3. Color: White.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements and other conditions affecting performance of the Work.
 - 1. Verify that roof openings and penetrations are in place, curbs are set and braced, and roof-drain bodies are securely clamped in place.
 - 2. Verify that wood blocking, curbs, and nailers are securely anchored to roof deck at penetrations and terminations and that nailers match thicknesses of insulation.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Clean substrate of dust, debris, moisture, and other substances detrimental to roofing system installation according to roofing system manufacturer's written instructions. Remove sharp projections.
- B. Prevent materials from entering and clogging roof drains and conductors and from spilling or migrating onto surfaces of other construction. Remove roof-drain plugs when no work is taking place or when rain is forecast.

3.3 ROOFING INSTALLATION, GENERAL

- A. Install roofing system according to roofing system manufacturer's written instructions.
- B. Complete terminations and base flashings and provide temporary seals to prevent water from entering completed sections of roofing system at end of workday or when rain is forecast. Remove and discard temporary seals before beginning Work on adjoining roofing.
- C. Install roofing and auxiliary materials to tie in to existing roofing to maintain weathertightness of transition.

3.4 VAPOR RETARDER INSTALLATION

- A. Laminate Sheet: Loosely lay laminate-sheet vapor retarder in a single layer over area to receive vapor retarder, side and end lapping each sheet a minimum of 2 and 6-inches, respectively.
 - 1. Extend vertically up parapet walls and projections to a minimum height equal to height of insulation and cover board.
 - 2. Continuously seal side and end laps with tape.
- B. Completely seal vapor retarder at terminations, obstructions, and penetrations to prevent air movement into roofing system.

3.5 INSULATION INSTALLATION

- A. Coordinate installing roofing system components, so insulation is not exposed to precipitation or left exposed at end of workday.
- B. Comply with roofing system and roof insulation manufacturer's written instructions for installing roof insulation.
- C. Install insulation under area of roofing to conform to slopes indicated. Roof to be at least 1/4-per foot slope.
- D. Install insulation under area of roofing to achieve required thickness of at least 4-inches. Where overall insulation thickness is 2.7-inches or greater, install two or more layers with joints of each succeeding layer staggered from joints of previous layer a minimum of 6-inches in each direction.
 - 1. Where installing composite and noncomposite insulation in two or more layers, install noncomposite board insulation for bottom layer and intermediate layers, if applicable, and install composite board insulation for top layer.
- E. Trim surface of insulation where necessary at roof drains so completed surface is flush and does not restrict flow of water.
- F. Install insulation with long joints of insulation in a continuous straight line with end joints staggered between rows, abutting edges and ends between boards. Fill gaps exceeding 1/4-inch with insulation.
 - 1. Cut and fit insulation within 1/4-inch of nailers, projections, and penetrations.

3.6 INSTALLATION OF COVER BOARDS

- A. Install cover boards over insulation with long joints in continuous straight lines with end joints staggered between rows. Offset joints of insulation below a minimum of 6-inches in each direction.

1. Trim cover board neatly to fit around penetrations and projections, and to fit tight to intersecting sloping roof decks.
2. At internal roof drains, conform to slope of drain sump.
 - a. Trim cover board so that water flow is unrestricted.
3. Cut and fit cover board tight to nailers, projections, and penetrations.
4. Adhere cover board to substrate using adhesive according to FM Approvals' RoofNav assembly requirements and FM Global Property Loss Prevention Data Sheet 1-29 for specified Windstorm Resistance Classification, as follows:
 - a. Set cover board in ribbons of bead-applied insulation adhesive, firmly pressing and maintaining insulation in place.

3.7 ADHERED ROOFING INSTALLATION

- A. Adhere roof membrane over area to receive roofing according to roofing system manufacturer's written instructions.
- B. Unroll roof membrane and allow to relax before installing.
- C. Accurately align roof membrane, and maintain uniform side and end laps of minimum dimensions required by manufacturer. Stagger end laps.
- D. Bonding Adhesive: Apply to substrate and underside of roof membrane at rate required by manufacturer, and allow to partially dry before installing roof membrane. Do not apply to splice area of roof membrane.
- E. In addition to adhering, mechanically fasten roof membrane securely at terminations, penetrations, and perimeter of roofing.
- F. Apply roof membrane with side laps shingled with slope of roof deck where possible.
- G. Seams: Clean seam areas, overlap roof membrane, and hot-air weld side and end laps of roof membrane and sheet flashings, to ensure a watertight seam installation.
 1. Test lap edges with probe to verify seam weld continuity. Apply lap sealant to seal cut edges of roof membrane and sheet flashings.
 2. Verify field strength of seams a minimum of twice daily, and repair seam sample areas.
 3. Repair tears, voids, and lapped seams in roof membrane that do not comply with requirements.
- H. Spread sealant bed over deck-drain flange at roof drains, and securely seal roof membrane in place with clamping ring.

3.8 BASE FLASHING INSTALLATION

- A. Install sheet flashings and preformed flashing accessories and adhere to substrates according to roofing system manufacturer's written instructions.
- B. Apply bonding adhesive to substrate and underside of sheet flashing at required rate and allow to partially dry. Do not apply to seam area of flashing.
- C. Flash penetrations and field-formed inside and outside corners with cured or uncured sheet flashing.
- D. Clean seam areas, overlap, and firmly roll sheet flashings into the adhesive. Hot-air weld side and end laps to ensure a watertight seam installation.
- E. Terminate and seal top of sheet flashings and mechanically anchor to substrate through termination bars.

3.9 FIELD QUALITY CONTROL

- A. Testing Agency: Engage a qualified testing agency to perform tests and to inspect substrate conditions, surface preparation, roof membrane application, sheet flashings, protection, and drainage components, and to furnish reports to Architect.
- B. Final Roof Inspection: Arrange for roofing system manufacturer's technical personnel to inspect roofing installation on completion, in presence of Architect, and to prepare inspection report.
- C. Repair or remove and replace components of roofing system where inspections indicate that they do not comply with specified requirements.
- D. Additional testing and inspecting, at Contractor's expense, will be performed to determine if replaced or additional work complies with specified requirements.

3.10 PROTECTING AND CLEANING

- A. Protect roofing system from damage and wear during remainder of construction period. When remaining construction does not affect or endanger roofing system, inspect roofing system for deterioration and damage, describing its nature and extent in a written report, with copies to Architect and Owner.
- B. Correct deficiencies in or remove roofing system that does not comply with requirements, repair substrates, and repair or reinstall roofing system to a condition free of damage and deterioration at time of Substantial Completion and according to warranty requirements.
- C. Clean overspray and spillage from adjacent construction using cleaning agents and procedures recommended by manufacturer of affected construction.

3.11 ROOFING INSTALLER'S WARRANTY

- A. WHEREAS _____ of _____, herein called the "Roofing Installer," has performed roofing and associated work ("work") on the following project:
1. Owner:
 2. Address:
 3. Building Name/Type:
 4. Address:
 5. Area of Work:
 6. Acceptance Date: _____.
 7. Warranty Period:
 8. Expiration Date: _____.
- B. AND WHEREAS Roofing Installer has contracted (either directly with Owner or indirectly as a subcontractor) to warrant said work against leaks and faulty or defective materials and workmanship for designated Warranty Period,
- C. NOW THEREFORE Roofing Installer hereby warrants, subject to terms and conditions herein set forth, that during Warranty Period Roofing Installer will, at Roofing Installer's own cost and expense, make or cause to be made such repairs to or replacements of said work as are necessary to correct faulty and defective work and as are necessary to maintain said work in a watertight condition.
- D. This Warranty is made subject to the following terms and conditions:
1. Specifically excluded from this Warranty are damages to work and other parts of the building, and to building contents, caused by:
 - a. lightning;
 - b. peak gust wind speed exceeding
 - c. fire;
 - d. failure of roofing system substrate, including cracking, settlement, excessive deflection, deterioration, and decomposition;

- e. faulty construction of parapet walls, copings, chimneys, skylights, vents, equipment supports, and other edge conditions and penetrations of the work;
 - f. vapor condensation on bottom of roofing; and
 - g. activity on roofing by others, including construction contractors, maintenance personnel, other persons, and animals, whether authorized or unauthorized by Owner.
- 2. When work has been damaged by any of foregoing causes, Warranty shall be null and void until such damage has been repaired by Roofing Installer and until cost and expense thereof have been paid by Owner or by another responsible party so designated.
 - 3. Roofing Installer is responsible for damage to work covered by this Warranty but is not liable for consequential damages to building or building contents resulting from leaks or faults or defects of work.
 - 4. During Warranty Period, if Owner allows alteration of work by anyone other than Roofing Installer, including cutting, patching, and maintenance in connection with penetrations, attachment of other work, and positioning of anything on roof, this Warranty shall become null and void on date of said alterations, but only to the extent said alterations affect work covered by this Warranty. If Owner engages Roofing Installer to perform said alterations, Warranty shall not become null and void unless Roofing Installer, before starting said work, shall have notified Owner in writing, showing reasonable cause for claim, that said alterations would likely damage or deteriorate work, thereby reasonably justifying a limitation or termination of this Warranty.
 - 5. During Warranty Period, if original use of roof is changed and it becomes used for, but was not originally specified for, a promenade, work deck, spray-cooled surface, flooded basin, or other use or service more severe than originally specified, this Warranty shall become null and void on date of said change, but only to the extent said change affects work covered by this Warranty.
 - 6. Owner shall promptly notify Roofing Installer of observed, known, or suspected leaks, defects, or deterioration and shall afford reasonable opportunity for Roofing Installer to inspect work and to examine evidence of such leaks, defects, or deterioration.
 - 7. This Warranty is recognized to be the only warranty of Roofing Installer on said work and shall not operate to restrict or cut off Owner from other remedies and resources lawfully available to Owner in cases of roofing failure. Specifically, this Warranty shall not operate to relieve Roofing Installer of responsibility for performance of original work according to requirements of the Contract Documents, regardless of whether Contract was a contract directly with Owner or a subcontract with Owner's General Contractor.

E. IN WITNESS THEREOF, this instrument has been duly executed this _____ day of _____, _____.

- 1. Authorized Signature: _____.
- 2. Name: _____.
- 3. Title: _____.

END OF SECTION 075423

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SECTION 078100 - APPLIED FIREPROOFING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section includes sprayed fire-resistive materials.
- B. Related Requirements:
 - 1. Section 051200 - "Structural Steel Framing" for application substrate where required for rating.
 - 2. Section 053100 - "Steel Decking" for application substrate where required for rating.
 - 3. Section 078123 - "Intumescent Fireproofing" for fire-resistive application.
 - 4. Section 099123 - "Interior Painting" for painting sprayed applied fireproofing at Training Room exposed ceiling.

1.3 DEFINITIONS

- A. SFRM: Sprayed fire-resistive materials.

1.4 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site.
 - 1. Review products, design ratings, restrained and unrestrained conditions, densities, thicknesses, bond strengths, and other performance requirements.

1.5 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Shop Drawings: Framing plans or schedules, or both, indicating the following:
 - 1. Extent of fireproofing for each construction and fire-resistance rating.
 - 2. Applicable fire-resistance design designations of a qualified testing and inspecting agency acceptable to authorities having jurisdiction.
 - 3. Minimum fireproofing thicknesses needed to achieve required fire-resistance rating of each structural component and assembly.

4. Treatment of fireproofing after application.

1.6 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For Installer and testing agency.
- B. Product Certificates: For each type of fireproofing.
- C. Evaluation Reports: For fireproofing, from ICC-ES.
- D. Preconstruction Test Reports: For fireproofing.
- E. Field quality-control reports.

1.7 QUALITY ASSURANCE

- A. Installer Qualifications: A firm or individual certified, licensed, or otherwise qualified by fireproofing manufacturer as experienced and with sufficient trained staff to install manufacturer's products according to specified requirements.
- B. Mockups: Build mockups Indicate portion of Work represented by mockup on Drawings or draw mockup as separate element.
 1. Build mockup of as shown on Drawings.
 2. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.

1.8 PRECONSTRUCTION TESTING

- A. Preconstruction Adhesion and Compatibility Testing: Test for compliance with requirements for specified performance and test methods.
 1. Bond Strength: Test for cohesive and adhesive strength according to ASTM E 736. Provide bond strength indicated in referenced fire-resistance design, but not less than minimum specified in Part 2.
 2. Density: Test for density according to ASTM E 605. Provide density indicated in referenced fire-resistance design, but not less than minimum specified in Part 2.
 3. Verify that manufacturer, through its own laboratory testing or field experience, attests that primers or coatings are compatible with fireproofing.
 4. Schedule sufficient time for testing and analyzing results to prevent delaying the Work.
 5. For materials failing tests, obtain applied-fireproofing manufacturer's written instructions for corrective measures including the use of specially formulated bonding agents or primers.

1.9 FIELD CONDITIONS

- A. Environmental Limitations: Do not apply fireproofing when ambient or substrate temperature is 40 deg F or lower unless temporary protection and heat are provided to maintain temperature at or above this level for 24 hours before, during, and for 24 hours after product application.
- B. Ventilation: Ventilate building spaces during and after application of fireproofing, providing complete air exchanges according to manufacturer's written instructions. Use natural means or, if they are inadequate, forced-air circulation until fireproofing dries thoroughly.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Description: Provide fireproofing at the following locations: Refer to Indiana Building Code (IBC) Tables 601 and 602 "Fire Resistance Rating for Building Elements".
 - 1. Primary Structural Steel Framing: 2-hour rating which includes:
 - a. Columns.
 - b. Structural members having direct connections to the columns, including girders, beams trusses and spandrels.
 - c. Members of the floor construction and roof construction having direct connections to columns.
 - d. Bracing members that are essential to the vertical stability of the primary structural frame under gravity loading shall be considered part of the primary structural frame whether or not the bracing member carries gravity loads.
 - 2. Roof Assembly: 1- hour rating which includes:
 - a. Metal roof deck.
 - b. Roof framing members supporting roofs only.
- B. Assemblies: Provide fireproofing, including auxiliary materials, according to requirements of each fire-resistance design and manufacturer's written instructions.
- C. Source Limitations: Obtain fireproofing from single source.
- D. Fire-Resistance Design: Indicated on Drawings, tested according to ASTM E 119 or UL 263; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
 - 1. Steel members are to be considered unrestrained unless specifically noted otherwise.
- E. Asbestos: Provide products containing no detectable asbestos.

2.2 SPRAYED FIRE-RESISTIVE MATERIALS

- A. High-Density Sprayed Fire-Resistive Material: Manufacturer's standard, factory-mixed, lightweight, dry formulation, complying with indicated fire-resistance design, and mixed with water at Project site to form a slurry or mortar before conveyance and application.
1. Basis-of-Design Product: Subject to compliance with requirements, provide Monokote MK6 HY by GCP Applied Technologies or comparable material by:
 - a. Isolatek International.
 2. Application: Designated for interior use by a qualified testing agency acceptable to authorities having jurisdiction.
 3. Bond Strength: Minimum 200-lbf/sq. ft. cohesive and adhesive strength based on field testing according to ASTM E 736.
 4. Density: Not less than 15 lb/cf density according to ASTM E 605.
 5. Surface-Burning Characteristics: Comply with ASTM E 84; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
 - a. Flame-Spread Index: 10 or less.
 - b. Smoke-Developed Index: 10 or less.
 6. Corrosion Resistance: No evidence of corrosion according to ASTM E 937.
 7. Deflection: No cracking, spalling, or delamination according to ASTM E 759.
 8. Effect of Impact on Bonding: No cracking, spalling, or delamination according to ASTM E 760.
 9. Air Erosion: Maximum weight loss of 0.005 g/sq. ft. in 24 hours according to ASTM E 859.
 10. Fungal Resistance: Treat products with manufacturer's standard antimicrobial formulation to result in no growth on specimens per ASTM G 21.
 11. Finish: As selected by Architect from manufacturer's standard finishes.
- B. Medium-Density Sprayed Fire-Resistive Material: Manufacturer's standard, factory-mixed, lightweight, dry formulation, complying with indicated fire-resistance design, and mixed with water at Project site to form a slurry or mortar before conveyance and application.
1. Basis-of-Design Product: Subject to compliance with requirements, provide Z106G medium-density cementitious fireproofing as manufactured by GCP Applied Technologies or a comparable product by:
 - a. Isolatek International.
 2. Bond Strength: Minimum 600-lbf/sq. ft. cohesive and adhesive strength based on field testing according to ASTM E 736.
 3. Density: Not less than 21 lb/cf density according to ASTM E 605.
 4. Thickness: As required for fire-resistance design indicated, measured according to requirements of fire-resistance design or ASTM E 605, whichever is thicker, but not less than 0.375-inch.

5. Surface-Burning Characteristics: Comply with ASTM E 84; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
 - a. Flame-Spread Index: 10 or less.
 - b. Smoke-Developed Index: 10 or less.
6. Compressive Strength: Minimum 50 PSI according to ASTM E 761.
7. Corrosion Resistance: No evidence of corrosion according to ASTM E 937.
8. Deflection: No cracking, spalling, or delamination according to ASTM E 759.
9. Effect of Impact on Bonding: No cracking, spalling, or delamination according to ASTM E 760.
10. Air Erosion: Maximum weight loss of 0.025 g/sq. ft. in 24 hours according to ASTM E 859.
11. Fungal Resistance: Treat products with manufacturer's standard antimicrobial formulation to result in no growth on specimens per ASTM G 21.
12. Finish: As selected by Architect from manufacturer's standard finishes.

2.3 AUXILIARY MATERIALS

- A. General: Provide auxiliary materials that are compatible with fireproofing and substrates and are approved by UL or another testing and inspecting agency acceptable to authorities having jurisdiction for use in fire-resistance designs indicated.
- B. Substrate Primers: Primers approved by fireproofing manufacturer and complying with one or both of the following requirements:
 1. Primer and substrate are identical to those tested in required fire-resistance design by UL or another testing and inspecting agency acceptable to authorities having jurisdiction.
 2. Primer's bond strength in required fire-resistance design complies with specified bond strength for fireproofing and with requirements in UL's "Fire Resistance Directory" or in the listings of another qualified testing agency acceptable to authorities having jurisdiction, based on a series of bond tests according to ASTM E 736.
- C. Bonding Agent: Product approved by fireproofing manufacturer and complying with requirements in UL's "Fire Resistance Directory" or in the listings of another qualified testing agency acceptable to authorities having jurisdiction.
- D. Metal Lath: Expanded metal lath fabricated from material of weight, configuration, and finish required, according to fire-resistance designs indicated and fireproofing manufacturer's written instructions. Include clips, lathing accessories, corner beads, and other anchorage devices required to attach lath to substrates and to receive fireproofing.
- E. Reinforcing Fabric: Glass or carbon-fiber fabric of type, weight, and form required to comply with fire-resistance designs indicated; approved and provided by fireproofing manufacturer.

- F. Reinforcing Mesh: Metallic mesh reinforcement of type, weight, and form required to comply with fire-resistance design indicated; approved and provided by fireproofing manufacturer. Include pins and attachment.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for substrates and other conditions affecting performance of the Work and according to each fire-resistance design.
 - 1. Verify that substrates are free of dirt, oil, grease, release agents, rolling compounds, mill scale, loose scale, incompatible primers, paints, and encapsulants, or other foreign substances capable of impairing bond of fireproofing with substrates under conditions of normal use or fire exposure.
 - 2. Verify that objects penetrating fireproofing, including clips, hangers, support sleeves, and similar items, are securely attached to substrates.
 - 3. Verify that substrates receiving fireproofing are not obstructed by ducts, piping, equipment, or other suspended construction that will interfere with fireproofing application.
- B. Verify that concrete work on steel deck is complete before beginning fireproofing work.
- C. Verify that roof construction, installation of rooftop HVAC equipment, and other related work are complete before beginning fireproofing work.
- D. Conduct tests according to fireproofing manufacturer's written instructions to verify that substrates are free of substances capable of interfering with bond.
- E. Prepare written report, endorsed by Installer, listing conditions detrimental to performance of the Work.
- F. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Cover other work subject to damage from fallout or overspray of fireproofing materials during application.
- B. Clean substrates of substances that could impair bond of fireproofing.
- C. Prime substrates where included in fire-resistance design and where recommended in writing by fireproofing manufacturer unless compatible shop primer has been applied and is in satisfactory condition to receive fireproofing.

- D. For applications visible on completion of Project, repair substrates to remove surface imperfections that could affect uniformity of texture and thickness in finished surface of fireproofing. Remove minor projections and fill voids that would telegraph through fire-resistant products after application.

3.3 APPLICATION

- A. Construct fireproofing assemblies that are identical to fire-resistance design indicated and products as specified, tested, and substantiated by test reports; for thickness, primers, sealers, topcoats, finishing, and other materials and procedures affecting fireproofing work.
- B. Comply with fireproofing manufacturer's written instructions for mixing materials, application procedures, and types of equipment used to mix, convey, and apply fireproofing; as applicable to conditions of installation and as required to achieve fire-resistance ratings indicated.
- C. Coordinate application of fireproofing with other construction to minimize need to cut or remove fireproofing.
 - 1. Do not begin applying fireproofing until clips, hangers, supports, sleeves, and other items penetrating fireproofing are in place.
 - 2. Defer installing ducts, piping, and other items that would interfere with applying fireproofing until application of fireproofing is completed.
- D. Metal Decks:
 - 1. Do not apply fireproofing to underside of metal deck substrates until concrete topping, if any, is completed.
 - 2. Do not apply fireproofing to underside of metal roof deck until roofing is completed; prohibit roof traffic during application and drying of fireproofing.
- E. Install auxiliary materials as required, as detailed, and according to fire-resistance design and fireproofing manufacturer's written instructions for conditions of exposure and intended use. For auxiliary materials, use attachment and anchorage devices of type recommended in writing by fireproofing manufacturer.
- F. Spray apply fireproofing to maximum extent possible. After the spraying operation in each area, complete the coverage by trowel application or other placement method recommended in writing by fireproofing manufacturer.
- G. Extend fireproofing in full thickness over entire area of each substrate to be protected.
- H. Install body of fireproofing in a single course unless otherwise recommended in writing by fireproofing manufacturer.
- I. Provide a uniform finish complying with description indicated for each type of fireproofing material and matching finish approved for required mockups.
- J. Cure fireproofing according to fireproofing manufacturer's written instructions.

- K. Do not install enclosing or concealing construction until after fireproofing has been applied, inspected, and tested and corrections have been made to deficient applications.
- L. Finishes: Where indicated, apply fireproofing to produce the following finishes:
 - 1. Manufacturer's Standard Finishes: Finish according to manufacturer's written instructions for each finish selected.
- M. Special Inspections: Engage a qualified special inspector to perform the following special inspections:
 - 1. Test and inspect as required by the IBC, Subsection 1705.13, "Sprayed Fire-Resistant Materials."
- N. Perform the tests and inspections of completed Work in successive stages. Do not proceed with application of fireproofing for the next area until test results for previously completed applications of fireproofing show compliance with requirements. Tested values must equal or exceed values as specified and as indicated and required for approved fire-resistance design.
- O. Fireproofing will be considered defective if it does not pass tests and inspections.
 - 1. Remove and replace fireproofing that does not pass tests and inspections, and retest.
 - 2. Apply additional fireproofing, per manufacturer's written instructions, where test results indicate insufficient thickness, and retest.
- P. Prepare test and inspection reports.

3.4 CLEANING, PROTECTING, AND REPAIRING

- A. Cleaning: Immediately after completing spraying operations in each containable area of Project, remove material overspray and fallout from surfaces of other construction and clean exposed surfaces to remove evidence of soiling.
- B. Protect fireproofing, according to advice of manufacturer and Installer, from damage resulting from construction operations or other causes, so fireproofing is without damage or deterioration at time of Substantial Completion.
- C. As installation of other construction proceeds, inspect fireproofing and repair damaged areas and fireproofing removed due to work of other trades.
- D. Repair fireproofing damaged by other work before concealing it with other construction.
- E. Repair fireproofing by reapplying it using same method as original installation or using manufacturer's recommended trowel-applied product.

END OF SECTION 078100

.A.SECTION 078123 - INTUMESCENT FIREPROOFING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section includes mastic and intumescent fire-resistive coatings.
- B. Related Requirements:
 - 1. Section 051200 - "Structural Steel Framing" for application substrate where required for rating.
 - 2. Section 051213 - "Architecturally Exposed Structural Steel Framing" for application substrate where required aesthetics and rating.
 - 3. Section 053100 - "Steel Decking" for application substrate where required for rating.
 - 4. Section 078100 - "Applied Fireproofing" for sprayed fire-resistive materials (SFRM).

1.3 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site.
 - 1. Review products, design ratings, restrained and unrestrained conditions, thicknesses, and other performance requirements.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Shop Drawings: Framing plans or schedules, or both, indicating the following:
 - 1. Extent of fireproofing for each construction and fire-resistance rating.
 - 2. Applicable fire-resistance design designations of a qualified testing and inspecting agency acceptable to authorities having jurisdiction.
 - 3. Minimum fireproofing thicknesses needed to achieve required fire-resistance rating of each structural component and assembly.
 - 4. Treatment of fireproofing after application.
- C. Samples: For each exposed product and for each color and texture specified, in manufacturer's standard dimensions.

1.5 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For Installer and testing agency.
- B. Product Certificates: For each type of fireproofing.
- C. Evaluation Reports: For fireproofing, from ICC-ES.
- D. Field quality-control reports.

1.6 QUALITY ASSURANCE

- A. Installer Qualifications: A firm or individual certified, licensed, or otherwise qualified by fireproofing manufacturer as experienced and with sufficient trained staff to install manufacturer's products according to specified requirements.

1.7 FIELD CONDITIONS

- A. Environmental Limitations: Do not apply fireproofing when ambient or substrate temperature is 50 deg F or lower unless temporary protection and heat are provided to maintain temperature at or above this level for 24 hours before, during, and for 24 hours after product application.
- B. Ventilation: Ventilate building spaces during and after application of fireproofing, providing complete air exchanges according to manufacturer's written instructions. Use natural means or, if they are inadequate, forced-air circulation until fireproofing dries thoroughly.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Description: Provide fire-proofing at the following locations: Refer to Indiana Building Code (IBC) Tables 601 and 602 "Fire Resistance Rating for Building Elements".
 - 1. Primary Structural Steel Framing: 2-hour rating which includes:
 - a. Columns.
 - b. Structural members having direct connections to the columns, including girders, beams trusses and spandrels.
 - c. Members of the floor construction and roof construction having direct connections to columns.
 - d. Bracing members that are essential to the vertical stability of the primary structural frame under gravity loading shall be considered part of the primary structural frame whether or not the bracing member carries gravity loads.

2. Roof Assembly: 1- hour rating which includes:
 - a. Metal roof deck.
 - b. Roof framing members supporting roofs only.
- B. Provide intumescent fireproofing at these locations:
 1. Vestibule B1000.
 2. Lobby B1001.
- C. Assemblies: Provide fireproofing, including auxiliary materials, according to requirements of each fire-resistance design and manufacturer's written instructions.
- D. Source Limitations: Obtain fireproofing for each fire-resistance design from single source.
- E. Fire-Resistance Design: Indicated on Drawings, tested according to ASTM E 119 or UL 263; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
 1. Steel members are to be considered unrestrained unless specifically noted otherwise.
- F. Asbestos: Provide products containing no detectable asbestos.

2.2 MASTIC AND INTUMESCENT FIRE-RESISTIVE COATINGS

- A. Mastic and Intumescent Fire-Resistive Coating: Manufacturer's standard, factory-mixed formulation or factory-mixed, multicomponent system consisting of intumescent base coat and topcoat, and complying with indicated fire-resistance design.
 1. Basis-of-Design-Product: Subject to compliance with requirements, provide "A/D Firefilm III" as manufactured by Carboline Company or a comparable product by one of the following:
 - a. Albi Manufacturing; A Division of StanChem, Inc.
 - b. Hilti, Inc.
 - c. International Protective Coatings.
 - d. Isolatek International.
 - e. Sherwin-Williams Company (The).
 2. Application: Designated for "interior general purpose" and "conditioned interior space purpose" use by a qualified testing agency acceptable to authorities having jurisdiction.
 3. Thickness: As required for fire-resistance design indicated, measured according to requirements of fire-resistance design.
 4. Surface-Burning Characteristics: Comply with ASTM E 84; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
 - a. Flame-Spread Index: 25 or less.

5. Hardness: Not less than 65, Type D durometer, according to ASTM D 2240.
6. Density: 89 pcf.
7. Finish: Smooth.
 - a. Color and Gloss: As selected by Architect from manufacturer's full range.

2.3 AUXILIARY MATERIALS

- A. General: Provide auxiliary materials that are compatible with fireproofing and substrates and are approved by UL or another testing and inspecting agency acceptable to authorities having jurisdiction for use in fire-resistance designs indicated.
- B. Substrate Primers: Primers approved by fireproofing manufacturer and complying with required fire-resistance design by UL or another testing and inspecting agency acceptable to authorities having jurisdiction.
- C. Reinforcing Fabric: Glass- or carbon-fiber fabric of type, weight, and form required to comply with fire-resistance designs indicated; approved and provided by fireproofing manufacturer.
- D. Reinforcing Mesh: Metallic mesh reinforcement of type, weight, and form required to comply with fire-resistance design indicated; approved and provided by fireproofing manufacturer. Include pins and attachment.
- E. Topcoat: Suitable for application over applied fireproofing; of type recommended in writing by fireproofing manufacturer for each fire-resistance design.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for substrates and other conditions affecting performance of the Work and according to each fire-resistance design.
 1. Verify that substrates are free of dirt, oil, grease, release agents, rolling compounds, mill scale, loose scale, incompatible primers, paints, and encapsulants, or other foreign substances capable of impairing bond of fireproofing with substrates under conditions of normal use or fire exposure.
 2. Verify that objects penetrating fireproofing, including clips, hangers, support sleeves, and similar items, are securely attached to substrates.
 3. Verify that substrates receiving fireproofing are not obstructed by ducts, piping, equipment, or other suspended construction that will interfere with fireproofing application.
- B. Conduct tests according to fireproofing manufacturer's written instructions to verify that substrates are free of substances capable of interfering with bond.

- C. Prepare written report, endorsed by Installer, listing conditions detrimental to performance of the Work.
- D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Cover other work subject to damage from fallout or overspray of fireproofing materials during application.
- B. Clean substrates of substances that could impair bond of fireproofing.
- C. Prime substrates where included in fire-resistance design and where recommended in writing by fireproofing manufacturer unless compatible shop primer has been applied and is in satisfactory condition to receive fireproofing.
- D. For applications visible on completion of Project, repair substrates to remove surface imperfections that could affect uniformity of texture and thickness in finished surface of fireproofing. Remove minor projections and fill voids that would telegraph through fire-resistive products after application.

3.3 APPLICATION

- A. Construct fireproofing assemblies that are identical to fire-resistance design indicated and products as specified, tested, and substantiated by test reports; for thickness, primers, topcoats, finishing, and other materials and procedures affecting fireproofing work.
- B. Comply with fireproofing manufacturer's written instructions for mixing materials, application procedures, and types of equipment used to mix, convey, and apply fireproofing; as applicable to conditions of installation and as required to achieve fire-resistance ratings indicated.
- C. Coordinate application of fireproofing with other construction to minimize need to cut or remove fireproofing.
 - 1. Do not begin applying fireproofing until clips, hangers, supports, sleeves, and other items penetrating fireproofing are in place.
 - 2. Defer installing ducts, piping, and other items that would interfere with applying fireproofing until application of fireproofing is completed.
- D. Install auxiliary materials as required, as detailed, and according to fire-resistance design and fireproofing manufacturer's written instructions for conditions of exposure and intended use. For auxiliary materials, use attachment and anchorage devices of type recommended in writing by fireproofing manufacturer.
- E. Spray apply fireproofing to maximum extent possible. After the spraying operation in each area, complete the coverage by trowel application or other placement method recommended in writing by fireproofing manufacturer.

- F. Extend fireproofing in full thickness over entire area of each substrate to be protected.
- G. Install body of fireproofing in a single course unless otherwise recommended in writing by fireproofing manufacturer.
- H. Provide a uniform finish complying with description indicated for each type of fireproofing material and matching finish approved for required mockups.
- I. Cure fireproofing according to fireproofing manufacturer's written instructions.
- J. Do not install enclosing or concealing construction until after fireproofing has been applied, inspected, and tested and corrections have been made to deficient applications.
- K. Finishes: Where indicated, apply fireproofing to produce the following finishes:
 - 1. Manufacturer's Standard Finishes: Finish according to manufacturer's written instructions for each finish selected.
 - 2. Spray-Textured Finish: Finish left as spray applied with no further treatment.
 - 3. Rolled, Spray-Textured Finish: Even finish produced by rolling spray-applied finish with a damp paint roller to remove drippings and excessive roughness.

3.4 FIELD QUALITY CONTROL

- A. Perform the tests and inspections of completed Work in successive stages. Do not proceed with application of fireproofing for the next area until test results for previously completed applications of fireproofing show compliance with requirements. Tested values must equal or exceed values as specified and as indicated and required for approved fire-resistance design.
- B. Fireproofing will be considered defective if it does not pass tests and inspections.
 - 1. Remove and replace fireproofing that does not pass tests and inspections, and retest.
 - 2. Apply additional fireproofing, per manufacturer's written instructions, where test results indicate insufficient thickness, and retest.
- C. Prepare test and inspection reports.

3.5 CLEANING, PROTECTING, AND REPAIRING

- A. Cleaning: Immediately after completing spraying operations in each containable area of Project, remove material overspray and fallout from surfaces of other construction and clean exposed surfaces to remove evidence of soiling.
- B. Protect fireproofing, according to advice of manufacturer and Installer, from damage resulting from construction operations or other causes, so fireproofing is without damage or deterioration at time of Substantial Completion.
- C. As installation of other construction proceeds, inspect fireproofing and repair damaged areas and fireproofing removed due to work of other trades.

- D. Repair fireproofing by reapplying it using same method as original installation or using manufacturer's recommended trowel-applied product.

END OF SECTION 078123

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SECTION 084523 - FIBERGLASS-SANDWICH-PANEL ASSEMBLIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section includes aluminum-framed assemblies incorporating fiberglass-sandwich panels as follows:
 - 1. Prefabricated pyramid skylight assemblies.
 - 2. Prefabricated flat skylight assemblies.
- B. Related Requirements:
 - 1. Section 055963 "Detention Enclosures" for security screens at skylight assemblies.
 - 2. Section 075423 "Thermoplastic Polyolefin (TPO) Roofing" for roofing at curbs for skylight assemblies.

1.3 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product.
 - 1. Include construction details, material descriptions, dimensions of individual components and profiles and finishes for aluminum components of panel assemblies.
- B. Shop Drawings: For panel assemblies.
 - 1. Include plans, elevations, sections, details, and attachments to other work.
 - 2. Include details of provisions for assembly expansion and contraction and for draining moisture within the assembly to the exterior.
- C. Samples: In manufacturer's standard size.
 - 1. For each type of fiberglass-sandwich panel.
 - 2. For each type of exposed finish for framing members.

- D. Delegated-Design Submittal: For panel assemblies indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1.5 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For qualified Installer, manufacturer and testing agency.
- B. Product Test Reports: For each fiberglass-sandwich-panel assembly, for tests performed by a qualified testing agency.
- C. Evaluation Reports: For fiberglass-sandwich-panel assemblies from ICC-ES.
- D. Field quality-control reports.
- E. Sample Warranties: For special warranties.

1.6 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For panel assemblies to include in maintenance manuals.

1.7 QUALITY ASSURANCE

- A. Manufacturer Qualifications: For fiberglass-sandwich panels, a qualified manufacturer whose facilities, processes, and products are monitored by an independent, accredited quality-control agency for compliance with applicable requirements in ICC-ES AC04 or ICC-ES AC177.
- B. Erection shall be by a factory-approved installer who has been in the business of erecting similar material for at least five (5) consecutive years and can show evidence of satisfactory completion of projects of similar size, scope and type.
- C. The manufacturer shall be responsible for the configuration and fabrication of the complete panel system, in accordance with the requirements of this specification.
- D. The glazing panels must be evaluated and listed by recognized building code evaluation organization: International Council Evaluation Service Inc (ICC-ES)

1.8 WARRANTY

- A. Manufacturer's Warranty: Manufacturer agrees to repair or replace components of panel assemblies that fail in materials or workmanship within specified warranty period.
 - 1. Failures include, but are not limited to, the following:
 - a. Structural failures including, but not limited to, excessive deflection.
 - b. Deterioration of metals, metal finishes, and other materials beyond normal weathering.
 - c. Water leakage.

2. Warranty Period: One (1) year from date of Substantial Completion.
- B. Manufacturer's Special Warranty: Manufacturer agrees to repair or replace fiberglass-sandwich panels that exhibit defects in materials or workmanship within specified warranty period.
1. Defects include, but are not limited to, the following:
 - a. Fiberbloom.
 - b. Delamination of coating, if any, from exterior face sheet.
 - c. Color change exceeding requirements.
 - d. Delamination of panel face sheets from panel cores.
 2. Warranty Period: Ten (10) years from date of Substantial Completion.
- C. Special Aluminum-Finish Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components on which finishes fail within specified warranty period. Warranty does not include normal weathering.
1. Failures include, but are not limited to, checking, crazing, peeling, chalking, and fading of finishes.
 2. Warranty Period: Five (5) years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Delegated Design: Engage a qualified professional engineer, as defined in Section 014000 "Quality Requirements," to design fiberglass-sandwich-panel assemblies.
- B. Structural Loads: As indicated on Drawings.
- C. Deflection Limits:
1. Overhead Panel Assemblies: Standard panels shall deflect no more than 1.9-inches at 30 PSF in 10 ft. span without a supporting frame by ASTM E 72.
- D. Structural-Test Performance: Provide panel assemblies tested according to ASTM E 330, as follows:
1. When tested at positive and negative wind-load design pressures, assemblies do not show evidence of deflection exceeding specified limits.
 2. When tested at 150 percent of positive and negative wind-load design pressures, assemblies, including anchorage, do not show evidence of material failures, structural distress, and permanent deformation of main framing members exceeding 0.2 percent of span.
 3. Test Durations: As required by design wind velocity, but not less than 10 seconds.

- E. Water Penetration under Static Pressure: Provide panel assemblies that do not evidence water penetration through fixed glazing and framing areas when tested according to ASTM E 331 at a minimum static-air-pressure difference of 20 percent of positive wind-load design pressure, but not less than 6.24 lbf/sq. ft.
- F. Water Penetration under Dynamic Pressure: Provide panel assemblies that do not evidence water leakage through fixed glazing and framing areas when tested according to AAMA 501.1 under dynamic pressure equal to 20 percent of positive wind-load design pressure, but not less than 6.24 lbf/sq. ft.
 - 1. Maximum Water Leakage: According to AAMA 501.1, no uncontrolled water penetrating aluminum-framed systems or water appearing on systems' normally exposed interior surfaces from sources other than condensation. Water leakage does not include water that is controlled by flashing and gutters and drained to the exterior, or water that cannot damage adjacent materials or finishes.
- G. Thermal Movements: Allow for thermal movements from ambient- and surface-temperature changes. Base calculations on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.
 - 1. Temperature Change (Range): 120 deg F, ambient; 180 deg F material surfaces.
- H. Energy Performance: Provide panel assemblies with performance properties specified, as indicated in manufacturer's published test data, based on procedures indicated below and certified and labeled according to NFRC:
 - 1. Thermal Transmittance (U-Factor): Fixed glazing and framing areas shall have U-factor of not more than 0.28 Btu/hr/ft²/deg total system as determined according to NFRC 100.
 - 2. Solar Heat Gain Coefficient (SHGC): Fixed glazing and framing areas shall have a SHGC of no greater than 0.28 as determined according to NFRC 200.
 - 3. Air Infiltration: Maximum air leakage through fixed glazing and framing areas of 0.06 cfm/sq. ft. of fixed wall area as determined according to ASTM E 283 at a minimum static-air-pressure differential of 6.24 lbf/sq. ft.
- I. Fall Through Resistance: Skylight system shall meet the fall through requirements of OSHA 1910.23 as demonstrated by testing in accordance with ASTM E 661, thereby not requiring supplemental screens or railings.
- J. Panel Strength:
 - 1. Maximum Panel Deflection: 3-1/2-inches when a 4-by-12-foot panel is tested according to ASTM E 72 at 34 lbf/sq. ft., with a maximum 0.090-inch set deflection after five minutes.
 - 2. Panel Support Strength: Capable of supporting, without failure, a 300-lbf concentrated load when applied to a 3-inch diameter disk according to ASTM E 661.
- K. Panel Performance:
 - 1. Self-Ignition Temperature: 650 deg F or more according to ASTM D 1929.

2. Smoke-Developed Index: 450 or less according to ASTM E 84, or 75 or less according to ASTM D 2843.
 3. Roof-Covering Classification: Class A according to ASTM E 108 or UL 790.
 4. Interior Face Sheets: Burn extent by ASTM D 635 shall be no greater than 1-inch.
 5. Color Change: Not more than 3.0 units Delta E, when measured according to ASTM D 2244, after outdoor weathering compliant with procedures in ASTM D 1435 and ASTM D 2244.
 6. Haze Factor: Greater than 90 percent when tested according to ASTM D 1003.
 7. Air Infiltration (ASTM E 283): Less than 0.01 cfm/Ft. squared at 6.24 PSF (50 mph).
 8. Burning Characteristics (ASTM E 84): Class CC@, burning rate of 2-1/2-inches per minute.
 9. Condensation Control: Integral internal gutters and non-clogging weeps to collect and drain condensation to the exterior.
- L. Sound Transmission Class (STC) Rating, provide materials and construction identical to those tested in assembly indicated according to ASTM E-90 and classified according to ASTM E 413 by an independent agency.
1. Sound Transmission Class (STC): Paired-panel assemblies shall have a minimum overall acoustic value of the following STC:
 2. Paired-Panel Assembly; 3-Inches Thick: STC [23]

2.2 FIBERGLASS-SANDWICH-PANEL ASSEMBLIES

- A. Fiberglass-Sandwich-Panel Assemblies: Translucent assemblies that are supported by aluminum framing and glazed with fiberglass-sandwich panels.
1. Basis-of-Design Product: Subject to compliance with requirements, provide "Pre-Engineered Pyramid Skylight" and "Ridge Span Skylight with Fixed HC Gable Ends System" as manufactured by Kalwall Corporation or comparable product by one of the following:
 - a. Major Industries, Inc.
 - b. CPI Daylighting.

2.3 FIBERGLASS-SANDWICH PANEL SKYLIGHT

- A. Prefabricated Roof Skylights:
1. Types: Pyramid and Flat S-Line types.
 2. Roof Panels.
 - a. 2-3/4-inch fiberglass sandwich panels.
 - b. High-impact FRP faces.
- B. Fiberglass-Sandwich Panels: Uniformly colored, translucent, thermoset, fiberglass-reinforced-polymer face sheets bonded to both sides of a grid core.

1. Core Insulation: Manufacturer's standard to meet energy performance requirements specified.
 2. Sizes: Refer to drawings.
- C. Panel Thickness: 2-3/4-inches.
- D. Panel Width: Not to exceed 2 ft.
- E. I-Beam Grid Core: Mechanically interlocked, extruded-aluminum I-beams, with a minimum flange width of 7/16-inch and 0.050-inch web thickness.
1. Extruded Aluminum: ASTM B 221, in alloy and temper recommended in writing by manufacturer.
 2. I-Beam Construction: Thermally-broken, extruded aluminum alloy 6061-T6.
 3. Grid Pattern: Inline rectangle, nominal 12 by 24-inches.
- F. Exterior Face Sheet:
1. Thickness: 0.070-inch.
 2. Color: Crystal.
 3. Protective Weathering Surface: Manufacturer's standard factory applied finish, which meets the performance requirements of AAMA 2604.
- G. Interior Face Sheet:
1. Thickness: 0.060-inch.
 2. Color: White.
- H. Fiberglass-Sandwich-Panel Adhesive: Manufacturer's standard for permanent adhesion of facings to cores.

2.4 ALUMINUM FRAMING SYSTEMS

- A. Components: Manufacturer's standard extruded-aluminum members of thickness required and reinforced as required to support imposed loads.
1. Construction: Thermally broken, extruded aluminum members with internal guttering system.
- B. Aluminum: Alloy and temper recommended in writing by manufacturer for type of use and finish indicated.
1. Sheet and Plate: ASTM B 209.
 2. Extruded Bars, Rods, Profiles, and Tubes: ASTM B 221.
 3. Extruded Structural Pipe and Tubes: ASTM B 429.
 4. Structural Profiles: ASTM B 308.
- C. Brackets and Reinforcements: Manufacturer's standard high-strength aluminum with nonstaining, nonferrous shims for aligning skylight components.

- D. Fasteners and Accessories: Manufacturer's standard, corrosion-resistant, nonstaining, and nonbleeding fasteners and accessories; compatible with adjacent materials.
 - 1. At closures, retaining caps, or battens, use ASTM A 193, 300 series stainless-steel screws.
 - 2. Use self-locking devices where fasteners are subject to loosening or turning out from thermal and structural movements, wind loads, or vibration.
 - 3. At movement joints, use slip-joint linings, spacers, and sleeves of material and type recommended in writing by manufacturer.
- E. Concrete and Masonry Inserts: Hot-dip galvanized cast-iron, malleable-iron, or steel inserts complying with ASTM A 123 or ASTM A 153 requirements.
- F. Anchor Bolts: ASTM A 307, Grade A, galvanized steel.
- G. Concealed Flashing: Corrosion-resistant, nonstaining, nonbleeding flashing compatible with adjacent materials.
- H. Exposed Flashing and Closures: Aluminum sheet not less than 0.063-inch thick, finished to match framing.
- I. Framing Gaskets: Manufacturer's standard,
- J. Frame-System Sealants: As recommended in writing by manufacturer.
- K. Corrosion-Resistant Coating: Cold-applied asphalt mastic, compounded for 15-mil dry film thickness per coat. Provide inert-type noncorrosive compound free of asbestos fibers, sulfur components, and other deleterious impurities.

2.5 FABRICATION

- A. Frame System Fabrication:
 - 1. Fabricate components that, when assembled, have the following characteristics:
 - a. Profiles that are sharp, straight, and free of defects or deformations.
 - b. Accurately fitted joints with ends coped or mitered.
 - c. Internal guttering systems or other means to drain water passing through joints, and moisture migrating within assembly to exterior.
 - 2. Fabricate sill closures with weep holes and for installation as continuous component.
 - 3. Reinforce components as required to receive fastener threads.
- B. Panel Fabrication: Factory assemble and seal panels.
 - 1. Laminate face sheets to grid core under a controlled process using heat and pressure to produce straight adhesive bonding lines that cover width of core members and that have sharp edges.

- a. White spots indicating lack of bond at intersections of grid-core members are limited in number to four for every 40-sq. ft. of panel and limited in diameter to 3/64-inch.
2. Fabricate with grid pattern that is symmetrical about centerlines of each panel.
3. Fabricate panel to allow condensation within panel to escape.
4. Reinforce panel corners.

2.6 METAL MATERIALS

- A. Extruded Aluminum shall be ANSI/ASTM B221; 6063-T6; 6063-T5 or 6005-T5.
- B. Flashing:
 1. 5005 H34 aluminum,
 2. Sheet metal flashings/closures/claddings are to be furnished shop formed to profile - when lengths exceed 10 ft. in nominal 10-ft lengths. Field trimming of the flashing and field forming the ends is necessary to suit as-built conditions. Sheet metal ends are to overlap at least 6-in. to 8-in., set in a full bed of sealant and riveted if required.
- C. All Fasteners for aluminum framing to be stainless steel or cadmium plated steel, excluding the final fasteners to the building.
- D. All Exposed Aluminum Finish: Shall be from manufacturer standard painted finish Aluminum #79 finish with ten (10) year warranty meeting the requirement of AAMA 2604

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine areas and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. General: Comply with manufacturer's written instructions.
 1. Do not install damaged components.
 2. Fit joints between aluminum components to produce hairline joints free of burrs and distortion.
 3. Rigidly secure nonmovement joints.
 4. Install anchors with separators and isolators to prevent metal corrosion, electrolytic deterioration, and immobilization of moving joints.
 5. Seal joints watertight unless otherwise indicated.

- B. Metal Protection: Where aluminum components will contact dissimilar materials, protect against galvanic action by painting contact surfaces with corrosion-resistant coating or by installing nonconductive spacers as recommended in writing by manufacturer for this purpose.
- C. Install components plumb and true in alignment with established lines and elevations.
- D. Skylight Assemblies: Install continuous aluminum sill closures with weatherproof expansion joints and locked and sealed corners. Locate weep holes at rafters. Install components to drain water passing through joints and moisture migrating within assembly to exterior.
- E. Erection Tolerances: Install panel assemblies to comply with the following maximum tolerances:
 - 1. Alignment: Limit offset from true alignment to 1/32-inch here surfaces abut in line, edge to edge, at corners, or where a reveal or protruding element separates aligned surfaces by less than 3-inches; otherwise, limit offset to 1/8-inch.
 - 2. Location and Plane: Limit variation from true location and plane to 1/8-inch in 12 feet, but no greater than 1/2-inch over total length.

3.3 FIELD QUALITY CONTROL

- A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.
 - 1. Water-Spray Test: Before installation of interior finishes has begun, panel assemblies shall be tested per AAMA 501.2 and shall not show evidence of water penetration.
 - 2. Water Penetration under Static Pressure: Before installation of interior finishes has begun, areas shall be tested according to ASTM E 1105 and ASTM E 331.
 - a. Water Penetration: None at 15 PSF.
- B. Repair or remove work where test results and inspections indicate that it does not comply with specified requirements.
- C. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.
- D. Prepare test and inspection reports.

END OF SECTION 084523

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HARDWARE SET S01 CELL DR - SWING

Each to Receive:

3	EA	HINGE	NW645 FMST x #30 Torx	US32D	NWSH
1	EA	ELECT JAMB LOCK	5022M - MSLH - 24VDC	USP	R R Brink
1	EA	LOOP PULL	NW 601	US32D	NWSH
1	EA	FLUSH PULL	NW 602	US32D	NWSH
1	EA	WALL STOP	NW706	BLACK	NWSH
3	EA	SILENCERS	608	GREY	Rockwood
1	EA	MAGNETIC DPS	201020	US32D	R R Brink

HARDWARE SET S01A CELL DR - SWING w/ FOOD PASS

Each to Receive:

3	EA	HINGE	NW 645 FMST x #30 Torx	US32D	NWSH
2	EA	FP HINGE	NW 631 FPB	USP	NWSH
1	EA	ELECT JAMB LOCK	5022M - MSLH - 24VDC	USP	R R Brink
1	EA	FOOD PASS LOCK	7017	USP	R R Brink
1	EA	LOOP PULL	NW 601	US32D	NWSH
1	EA	FLUSH PULL	NW 602	US32D	NWSH
1	EA	WALL STOP	NW706	BLACK	NWSH
3	EA	SILENCERS	608	GREY	Rockwood
1	EA	MAGNETIC DPS	201020	US32D	R R Brink

HARDWARE SET S01B S01a w/ CKS

Each to Receive:

3	EA	HINGE	NW 645 FMST x #30 Torx	US32D	NWSH by Cell Mfg'r
2	EA	FP HINGE	NW 631 FPB	USP	NWSH by Cell Mfg'r
1	EA	ELECT JAMB LOCK	5022M - MSLH - CKS - 24VDC	USP	R R Brink
1	EA	FOOD PASS LOCK	7017	USP	R R Brink
1	EA	LOOP PULL	NW 601	US32D	NWSH
1	EA	FLUSH PULL	NW 602	US32D	NWSH
1	EA	WALL STOP - SC	NW 706SC	BLACK	NWSH
3	EA	SILENCERS	608	GREY	Rockwood
1	EA	MAGNETIC DPS	201020	US32D	R R Brink

HARDWARE SET S01C S01B w/ Closer

Each to Receive:

3	EA	HINGE	NW 645 FMST x #30 Torx	US32D	NWSH
2	EA	FP HINGE	NW 631 FPB	USP	NWSH
1	EA	ELECT JAMB LOCK	5022M - MSLH - CKS - 24VDC	USP	R R Brink
1	EA	FOOD PASS LOCK	7017	USP	R R Brink
1	EA	LOOP PULL	NW 601	US32D	NWSH
1	EA	FLUSH PULL	NW 602	US32D	NWSH
1	EA	CONC CLOSER	2214	AL	LCN
1	EA	WALL STOP	NW 706	BLACK	NWSH
3	EA	SILENCERS	608	GREY	Rockwood
1	EA	MAGNETIC DPS	201020	US32D	R R Brink

HARDWARE SET S01D S01C w/o Food Pass

Each to Receive:

3	EA	HINGE	NW 645 FMST x #30 Torx	US32D	NWSH
1	EA	ELECT JAMB LOCK	5022M - MSLH - CKS - 24VDC	USP	R R Brink
1	EA	LOOP PULL	NW 601	US32D	NWSH
1	EA	FLUSH PULL	NW 602	US32D	NWSH
1	EA	CONC CLOSER	2214	AL	LCN
1	EA	WALL STOP	NW 706	BLACK	NWSH
3	EA	SILENCERS	608	GREY	Rockwood
1	EA	MAGNETIC DPS	201020	US32D	R R Brink

HARDWARE SET S02 Visitation Booth

Each to Receive:

3	EA	HINGE	NW645 FMST x #30 Torx	US32D	NWSH
1	EA	MECH LOCK	7072 - HM MTG - 7070KD - ESC (1-WAY)	USP	R R Brink
1	EA	LOOP PULL	NW 601	US32D	NWSH
1	EA	FLUSH PULL	NW 602	US32D	NWSH
1	EA	CONC CLOSER	2214	AL	LCN
1	EA	WALL STOP	NW 706	BLACK	NWSH
3	EA	SILENCERS	608	GREY	Rockwood

HARDWARE SET S02A S02 w/ Food Pass

Each to Receive:

3	EA	HINGE	NW 645 FMST x #30 Torx	US32D	NWSH
3	EA	FP HINGE	NW 631 FPB	USP	NWSH
1	EA	MECH LOCK	7072 - HM MTG - 7070KD - ESC (1-WAY)	USP	R R Brink
1	EA	FOOD PASS LOCK	7017	USP	R R Brink
1	EA	LOOP PULL	NW 601	US32D	NWSH
1	EA	FLUSH PULL	NW 602	US32D	NWSH
1	EA	CONC CLOSER	2214	AL	LCN
1	EA	WALL STOP	NW 706	BLACK	NWSH
3	EA	SILENCERS	608	GREY	Rockwood

HARDWARE SET S02B S02 w/o Closer

Each to Receive:

3	EA	HINGE	NW 645 FMST x #30 Torx	US32D	NWSH
1	EA	MECH LOCK	7072 - HM MTG - 7070KD - ESC (1-WAY)	USP	R R Brink
1	EA	LOOP PULL	NW 601	US32D	NWSH
1	EA	FLUSH PULL	NW 602	US32D	NWSH
1	EA	WALL STOP	NW 706	BLACK	NWSH
3	EA	SILENCERS	608	GREY	Rockwood

HARDWARE SET S02C S02 w/ Deadbolt Lock

Each to Receive:

3	EA	HINGE	NW 645 FMST x #30 Torx	US32D	NWSH
1	EA	MECH LOCK	7086 - HM MTG - 7080KD - 2/ESC (1-WAY)		USP R R Brink
1	EA	LOOP PULL	NW 601	US32D	NWSH
1	EA	FLUSH PULL	NW 602	US32D	NWSH
1	EA	WALL STOP	NW 706	BLACK	NWSH
3	EA	SILENCERS	608	GREY	Rockwood

HARDWARE SET S03 CHASE DOOR

Each to Receive:

3	EA	HINGE	NW 645 FMST x #30 Torx	US32D	NWSH
1	EA	DEADBOLT	7012 - HM MTG - 7010KD - ESC (1-WAY)		USP R R Brink
1	EA	COMBO PULL	NW 701 – TORX-MS	US32D	NWSH
1	EA	WALL STOP	NW 706	BLACK	NWSH

HARDWARE SET S03A SECURITY ACCESS PANEL

Each to Receive:

1	EA	DEADBOLT LOCK	7016 – ESC (1-WAY)	USP	R R Brink
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HARDWARE SET S04 CORRIDOR DOOR - SWING

Each to Receive:

3	EA	HINGE	NW 645 FMST x #30 Torx	US32D	NWSH
1	EA	ELECT JAMB LOCK	5026M - MSLH - 24VDC	USP	R R Brink
1	EA	LOOP PULL	NW 601	US32D	NWSH
1	EA	COMBO PULL	NW 701 - TORX MS	US32D	NWSH
1	EA	CONC CLOSER	2214	AL	LCN
1	EA	WALL STOP	NW 706	BLACK	NWSH
3	EA	SILENCERS	608	GREY	Rockwood
1	EA	MAGNETIC DPS	201020	US32D	R R Brink

HARDWARE SET S04a S04 for Wide Door

Each to Receive:

4	EA	HINGE	NW 645 FMST x #30 Torx	US32D	NWSH
1	EA	ELECT JAMB LOCK	5026M - MSLH - 24VDC	USP	R R Brink
1	EA	LOOP PULL	NW 601	US32D	NWSH
1	EA	COMBO PULL	NW 701 - TORX MS	US32D	NWSH
1	EA	CONC CLOSER	2214	AL	LCN
1	EA	WALL STOP	NW 706	BLACK	NWSH
3	EA	SILENCERS	608	GREY	Rockwood
1	EA	MAGNETIC DPS	201020	US32D	R R Brink

HARDWARE SET S04A DAYROOM DOOR - SWING

Each to Receive:

4	EA	HINGE	NW 645 FMST x #30 Torx	US32D	NWSH
2	EA	FP HINGE	NW 631 FPB	USP	NWSH
1	EA	ELECT JAMB LOCK	5026M - MSLH - 24VDC	USP	R R Brink
1	EA	FOOD PASS LOCK	7017	USP	R R Brink
1	EA	LOOP PULL	NW 601	US32D	NWSH
1	EA	COMBO PULL	NW 701 - TORX MS	US32D	NWSH
1	EA	CONC CLOSER	2214	AL	LCN
1	EA	WALL STOP	NW 706	BLACK	NWSH
3	EA	SILENCERS	608	GREY	Rockwood
1	EA	MAGNETIC DPS	201020	US32D	R R Brink

HARDWARE SET S05 CORRIDOR DOOR - SLIDER

Each to Receive:

1	EA	LOCKING DEVICE	57700ECP x K2S	USP	R R Brink
1	EA	LOOP PULL	NW 601	US32D	NWSH
1	EA	FLUSH PULL	BY SECURITY DOOR MFG.	USP	PJBC

HARDWARE SET S05A S05 for Fire Rated Opening

Each to Receive:

1	EA	LOCKING DEVICE	57700ECP x K2S	USP	R R Brink
1	EA	LOOP PULL	NW 601	US32D	NWSH
1	EA	FLUSH PULL	BY SECURITY DOOR MFG.	USP	PJBC
3	EA	GASKETING	5050C - 7'	CHAR	NGP
1	EA	SWEEP	601A-50"	AL	NGP
1	EA	SWEEP	602A-50"	AL	NGP

HARDWARE SET S06 DAYROOM TO DAYROOM

Each to Receive:

3	EA	HINGE	NW 645 FMST x #30 Torx	US32D	NWSH
1	EA	ELECT JAMB LOCK	5026M - MSLH - 24VDC	USP	R R Brink
2	EA	COMBO PULL	NW 701 - TORX MS	US32D	NWSH
1	EA	CONC CLOSER	2214	AL	LCN
1	EA	WALL STOP	NW 706	BLACK	NWSH
1	EA	THRESHOLD	8135-36" X TORX	AL	NGP
1	SET	GASKETING	5050C - 17'	CHAR	NGP
1	EA	MAGNETIC DPS	201020	US32D	R R Brink

HARDWARE SET S07 STORAGE DOOR - NO MONITORING

Each to Receive:

3	EA	HINGE	NW 645 FMST x #30 Torx	US32D	NWSH
1	EA	MECH LOCK	7086 - HM MTG - 7080KD - 2/ESC (1-WAY)	USP	R R Brink
2	EA	COMBO PULL	NW 701 - TORX-MS	US32D	NWSH
1	EA	WALL STOP	NW 706	BLACK	NWSH
3	EA	SILENCERS	608	GREY	Rockwood

HARDWARE SET S07A STORAGE DR W/MONITORING

Each to Receive:

3	EA	HINGE	NW 645 FMST x #30 Torx	US32D	NWSH
1	EA	MECH LOCK	7086 - HM MTG - 7080KS - 2/ESC (1-WAY)		USP R R Brink
1	EA	CONC CLOSER	2214	AL	LCN
1	EA	WALL STOP	NW 706	BLACK	NWSH
3	EA	SILENCERS	608	GREY	Rockwood
1	EA	MAGNETIC DPS	201020	US32D	R R Brink

HARDWARE SET S08 MECH DOOR w/LABEL

Each to Receive:

3	EA	HINGE	NW 645 FMST x #30 Torx	US32D	NWSH
1	EA	MECH LOCK	1042-401 x LE	26D	R R Brink
1	EA	KEEPER SWITCH	201040	US32D	R R Brink
1	EA	CONC CLOSER	2214	AL	LCN
1	EA	WALL STOP	NW 706	BLACK	NWSH
3	EA	SILENCERS	608	GREY	Rockwood
1	EA	MAGNETIC DPS	201020	US32D	R R Brink

HARDWARE SET S08A Dutch Door

Each to Receive:

4	EA	HINGE	NW 645 FMST x #30 Torx	US32D	NWSH
1	EA	SURFACE BOLT	580-8" X Torx MS	US26D	Rockwood
1	EA	MECH LOCK	1022-201 x LE	26D	R R Brink
1	EA	WALL STOP	NW 706	BLACK	NWSH
5	EA	LABOR	HOURS		PJBC
2	EA	HANDCUFF RING	NW 613WM	US32D	NWSH

HARDWARE SET S08B S08 NO MONITORING w/LABEL

Each to Receive:

3	EA	HINGE	NW 645 FMST x #30 Torx	US32D	NWSH
1	EA	MECH LOCK	1042-401 x LE	26D	R R Brink
1	EA	CONC CLOSER	2214	AL	LCN
1	EA	WALL STOP	NW 706	BLACK	NWSH
3	EA	SILENCERS	608	GREY	Rockwood

HARDWARE SET S09 EXTERIOR DOOR

Each to Receive:

3	EA	HINGE	NW 645 FMST x #30 Torx	US32D	NWSH
1	EA	ELECT JAMB LOCK	5026M - MSLH - 24VDC	USP	R R Brink
1	EA	LOOP PULL	NW 601	US32D	NWSH
1	EA	COMBO PULL	NW 701 - TORX MS	US32D	NWSH
1	EA	CONC CLOSER	2214	AL	LCN
1	EA	FLOOR STOP	NW 606	BLACK	NWSH
1	EA	THRESHOLD	896S-36" X TORX	AL	NGP
1	SET	WEATHERSTRIP	161SA-3070	AL	NGP
1	EA	MAGNETIC DPS	201020	US32D	R R Brink

HARDWARE SET S10 **CHAINLINK FENCE GATE**

Each to Receive:

1	EA	ELECT JAMB LOCK	5056M - MSLH – MOG – KCE - 24VDC	USP	R R Brink
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HARDWARE SET S20 **SPARE PARTS**

Each to Receive:

6	EA	HINGE	NW 645 FMST x #30 Torx	US32D	NWSH
6	EA	ELECT JAMB LOCK	5020M-MSLH - 24VDC	US32D	R R Brink
4	EA	CONC CLOSER	2214	AL	LCN
6	EA	MAGNETIC DPS	201020	US32D	R R Brink
1	SET	SWITCH	6 each type used		R R Brink
4	EA	MOTOR	5020M - 24VDC		R R Brink
2	EA	MOTOR	57700 Gear		R R Brink

SECTION 093000 - TILING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This Section includes the following:
 - 1. Porcelain tile for Rest Room walls and floors.
- B. Related Sections include the following:
 - 1. Division 07 Section "Joint Sealants" for sealing of expansion, contraction, control, and isolation joints in tile surfaces.

1.3 DEFINITIONS

- A. Module Size: Actual tile size (minor facial dimension as measured per ASTM C 499) plus joint width indicated.
- B. Facial Dimension: Nominal tile size as defined in ANSI A137.1.

1.4 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Shop Drawings: Show locations of each type of tile and tile pattern. Show widths, details, and locations of expansion, contraction, control, and isolation joints in tile substrates and finished tile surfaces.
- C. Samples for Initial Selection: For each type of tile and grout indicated. Include Samples of accessories involving color selection.
- D. Samples for Verification:
 - 1. Full-size units of each type and composition of tile and for each color and finish required.
 - 2. Assembled samples with grouted joints for each type and composition of tile and for each color and finish required, at least 12 inches (300 mm) square and mounted on rigid panel. Use grout of type and in color or colors approved for completed work.

3. Full-size units of each type of trim and accessory.

- E. Qualification Data: For Installer.

1.5 QUALITY ASSURANCE

- A. Source Limitations for Tile: Obtain all tile from one source or producer.

1. Obtain tile from same production run and of consistent quality in appearance and physical properties for each contiguous area.

- B. Source Limitations for Setting and Grouting Materials: Obtain ingredients of a uniform quality for each mortar, adhesive, and grout component from a single manufacturer and each aggregate from one source or producer.

- C. Mockups: Build mockups to verify selections made under sample Submittals and to demonstrate aesthetic effects.

1. Build mockup of wall tile installation.
2. Approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.6 PROJECT CONDITIONS

- A. Environmental Limitations: Do not install tile until construction in spaces is complete and ambient temperature and humidity conditions are maintained at the levels indicated in referenced standards and manufacturer's written instructions.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. In other Part 2 articles where titles below introduce lists, the following requirements apply for product selection:

1. Manufacturers: Subject to compliance with requirements, available products that may be incorporated into the Work include the manufacturers specified.

2.2 PRODUCTS, GENERAL

- A. ANSI Ceramic Tile Standard: Provide tile that complies with ANSI A137.1, "Specifications for Ceramic Tile," for types, compositions, and other characteristics indicated.

1. Provide tile complying with Standard grade requirements, unless otherwise indicated.

- B. ANSI Standards for Tile Installation Materials: Provide materials complying with ANSI standards referenced in "Setting and Grouting Materials" Article.
- C. Colors, Textures, and Patterns: From manufacture's standard selection.
- D. Factory Blending: For tile exhibiting color variations within ranges selected during Sample submittals, blend tile in factory and package so tile units taken from one package show same range in colors as those taken from other packages and match approved Samples.
- E. Mounting: For factory-mounted tile, provide back- or edge-mounted tile assemblies as standard with manufacturer, unless otherwise indicated.

2.3 TILE PRODUCTS

- A. Ceramic Wall Tile: Basis of Design- Stonepeak High-Tech Porcelain.

- 1. Ceramic Wall and Floor Tile:

- a. Style: Quartzite.
 - b. Type: Porcelain.
 - c. Application: Floor and Walls.

- 2. Or pre-approved equal by:

- a. American Olean; Div. of Dal-Tile International Corp.
 - b. Crossville Ceramics Company, L.P.
 - c. Daltile.
 - d. Florida Tile Industries, Inc.
 - e. Royal Mosa Tiles

- 3. Technical Data:

- a. Water Absorption: ASTM C373 < 0.1%.
 - b. Breaking Strength: ASTM C648 > 400 lbs.
 - c. Scratch Hardness: MOHS > 7.0.
 - d. Chemical Resistance: ASTM C650 Unaffected.
 - e. Bond Strength: > 200 psi.

- 4. Shower Wall Size: 12 x 12-inches.

- a. Thickness: 1/3-inch.

- 5. Show Floor Size: 2 x 4-Inches.

- a. Thickness: 1/3-inch.

- 6. Restroom Floor Size: 12 x 12-inches.

- a. Thickness: 1/3-inch.
- 7. Base: Bullnose 3 x 12
- 8. Edge: Rectified.
- 9. Finish: Matt.
- B. Trim:
 - 1. Provide necessary caps, stops, returns, trimmers and other shapes to complete installation.
 - 2. Color and finish: aluminum.
- C. Accessories:
 - 1. Base:
 - a. Schluter Systems LP.
 - 2. Option:
 - a. Custom Building Products
 - b. Blanke and Co.
 - c. Dural USA, Inc.

2.4 TILING AND GROUTING MATERIALS

- A. Manufacturers:
 - 1. Bonsal, W. R., Company.
 - 2. Bostik.
 - 3. DAP, Inc.
 - 4. LATICRETE International Inc.
 - 5. MAPEI Corporation.
 - 6. TEC Specialty Products Inc.
 - 7. Custom Building Products.
- B. Latex-Portland Cement Mortar (Thin Set): ANSI A118.4, consisting of the following:
 - 1. Prepackaged dry-mortar mix containing dry, redispersible, ethylene vinyl acetate additive to which only water must be added at Project site.
 - 2. Prepackaged dry-mortar mix combined with acrylic resin or styrene-butadiene-rubber liquid-latex additive.
 - a. For wall applications, provide nonsagging mortar that complies with Paragraph F-4.6.1 in addition to the other requirements in ANSI A118.4.
- C. Sand-Portland Cement Grout: ANSI A108.10, composed of white or gray cement and white or colored aggregate as required to produce color indicated.

2.5 MISCELLANEOUS MATERIALS

- A. Trowelable Patching Compounds: Latex-modified, portland cement-based formulation provided or approved by manufacturer of tile-setting materials for installations indicated.
- B. Tile Cleaner: A neutral cleaner capable of removing soil and residue without harming tile and grout surfaces, specifically approved for materials and installations indicated by tile and grout manufacturers.
- C. Grout Sealer: Manufacturer's standard silicone product for sealing grout joints that does not change color or appearance of grout.
 - 1. Products:
 - a. Bonsal, W. R., Company; Grout Sealer.
 - b. Bostik; CeramaSeal Grout Sealer.
 - c. MAPEI Corporation; KER 003, Silicone Spray Sealer for Cementitious Tile Grout.
 - d. Southern Grouts & Mortars, Inc.; Silicone Grout Sealer.
 - e. Summitville Tiles, Inc.; SL-15, Invisible Seal Penetrating Grout and Tile Sealer.
 - f. TEC Specialty Products Inc.; TA-256 Penetrating Silicone Grout Sealer.
 - g. Miracle.
 - h. Custom Building Products.
- D. Joint Compound for Tile Backing Panels:
 - 1. Cementitious Backer Units: As recommended by backer unit manufacturer.

2.6 MIXING MORTARS AND GROUT

- A. Mix mortars and grouts to comply with referenced standards and mortar and grout manufacturers' written instructions.
- B. Add materials, water, and additives in accurate proportions.
- C. Obtain and use type of mixing equipment, mixer speeds, mixing containers, mixing time, and other procedures to produce mortars and grouts of uniform quality with optimum performance characteristics for installations indicated.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions where tile will be installed, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of installed tile.

1. Verify that substrates for setting tile are firm; dry; clean; free of oil, waxy films, and curing compounds; and within flatness tolerances required by referenced ANSI A108 Series of tile installation standards for installations indicated.
 2. Verify that installation of grounds, anchors, recessed frames, electrical and mechanical units of work, and similar items located in or behind tile has been completed before installing tile.
 3. Verify that joints and cracks in tile substrates are coordinated with tile joint locations; if not coordinated, adjust joint locations in consultation with Architect.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Remove coatings, including curing compounds and other substances that contain soap, wax, oil, or silicone, that are incompatible with tile-setting materials.
- B. Blending: For tile exhibiting color variations within ranges selected during Sample submittals, verify that tile has been factory blended and packaged so tile units taken from one package show same range of colors as those taken from other packages and match approved Samples. If not factory blended, either return to manufacturer or blend tiles at Project site before installing.

3.3 INSTALLATION, GENERAL

- A. ANSI Tile Installation Standards: Comply with parts of ANSI A108 Series "Specifications for Installation of Ceramic Tile" that apply to types of setting and grouting materials and to methods indicated in ceramic tile installation schedules.
- B. TCA Installation Guidelines: TCA's "Handbook for Ceramic Tile Installation." Comply with TCA installation methods indicated in ceramic tile installation schedules.
- C. Extend tile work into recesses and under or behind equipment and fixtures to form complete covering without interruptions, unless otherwise indicated. Terminate work neatly at obstructions, edges, and corners without disrupting pattern or joint alignments.
- D. Accurately form intersections and returns. Perform cutting and drilling of tile without marring visible surfaces. Carefully grind cut edges of tile abutting trim, finish, or built-in items for straight aligned joints. Fit tile closely to electrical outlets, piping, fixtures, and other penetrations so plates, collars, or covers overlap tile.
- E. Jointing Pattern: Align joints when adjoining tiles on walls and trim are same size. Lay out tile work and center tile fields in both directions on each wall area. Adjust to minimize tile cutting. Provide uniform joint widths, unless otherwise indicated.
1. For tile mounted in sheets, make joints between tile sheets same width as joints within tile sheets so joints between sheets are not apparent in finished work.
- F. Provide 6" tall bull nose tile at exposed edge of wall tiles and at top of wainscot of tiled walls.

- G. Provide a 6" tall coved base tile on walls with ceramic wall tile.
- H. If tile ends in middle of wall, rather than wall to wall, provide end bull nosed tile.
- I. Grout tile to comply with requirements of the following tile installation standards:
 - 1. For ceramic tile grouts (sand-portland cement; dry-set, commercial portland cement; and latex-portland cement grouts), comply with ANSI A108.10.

3.4 APPLYING TILE BACKING PANELS

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

3.5 WALL TILE INSTALLATION

- A. Install types of tile designated for wall installations to comply with requirements in the Wall Tile Installation Schedule, including those referencing TCA installation methods and ANSI setting-bed standards.
- B. Joint Widths: Install tile on walls with joint width of 1/16-inch.

3.6 CLEANING AND PROTECTING

- A. Cleaning: On completion of placement and grouting, clean all ceramic tile surfaces so they are free of foreign matter.
 - 1. Remove grout residue from tile as soon as possible.
 - 2. Clean grout smears and haze from tile according to tile and grout manufacturer's written instructions, but no sooner than 10 days after installation. Use only cleaners recommended by tile and grout manufacturers and only after determining that cleaners are safe to use by testing on samples of tile and other surfaces to be cleaned. Protect metal surfaces and plumbing fixtures from effects of cleaning. Flush surfaces with clean water before and after cleaning.
- B. Before final inspection, remove protective coverings and rinse neutral cleaner from tile surfaces.

3.7 WALL TILE INSTALLATION SCHEDULE

- A. Tile Installation: Interior wall installation over cementitious backer units; thin-set mortar; TCA W244 and ANSI A108.5.
 - 1. Tile Type: Porcelain Wall and Floor tile.
 - 2. Thin-Set Mortar: Latex- portland cement mortar.
Grout: Sand-portland cement grout.
 - 3. Colors: As selected by the Architect from manufacturer's full range.
 - 4. Pattern to be determined.

5. Tile will be full height on showers walls.
6. Sizes: 12" x 12".
7. Provide base trim.

END OF SECTION 093000

SECTION 096623 - RESINOUS MATRIX TERRAZZO FLOORING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:

- 1. Thin-set, epoxy-resin terrazzo flooring with divider and accessory strips.

- B. Related Requirements:

- 1. Section 033000 – “Cast-in-Place Concrete” for concrete floor slab.
 - 2. Section 042200 – “Concrete Unit Masonry” for CMU base.
 - 3. Section 079200 - "Joint Sealants" for sealants installed with terrazzo.

1.3 DEFINITIONS

- A. Aggregate: Marble chips or other types of aggregate.

1.4 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site.

- 1. Review methods and procedures related to terrazzo including, but not limited to, the following:
 - a. Inspect and discuss condition of substrate and other preparatory work performed by other trades.
 - b. Review and finalize construction schedule and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
 - c. Review special terrazzo designs and patterns.

1.5 ACTION SUBMITTALS

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

- B. Shop Drawings: Include terrazzo installation requirements. Include plans, elevations, sections, component details, and attachments to other work. Show layout of the following:
 - 1. Divider strips.
 - 2. Control-joint strips.
 - 3. Accessory strips.
- C. Samples for Verification: For each type, material, color, and pattern of terrazzo and accessory required showing the full range of color, texture, and pattern variations expected. Label each terrazzo sample to identify manufacturer's matrix color and aggregate types, sizes, and proportions. Prepare samples of same thickness and from same material to be used for the Work, in size indicated below:
 - 1. Terrazzo: 6-inch-square Samples.
 - 2. Accessories: 6-inch-long Samples of each exposed strip item required.

1.6 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For Installer.
 - 1. Include list of projects indicating name and location of project, name of Owner, name and contact information for General Contractor, and name and contact information for Architect.
 - 2. Include letter from NTMA with the name of the Project and name of member, stating current member status
- B. Material Certificates: For each type of terrazzo material or product, from manufacturer.
 - 1. Epoxy Resin: For each type of resin required indicating that materials meet specification requirements, by manufacturer.
 - 2. Aggregate: For each type of aggregate required indicating compatibility with terrazzo mix, signed by aggregate supplier.
- C. Installer Certificates: Signed by manufacturers certifying that installers comply with requirements.

1.7 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For terrazzo to include in maintenance manuals.

1.8 QUALITY ASSURANCE

- A. Installer Qualifications:
 - 1. Engage an installer who is a contractor member of NTMA.

2. Engage an installer who is certified in writing by terrazzo manufacturer as qualified to install manufacturer's products.
- B. Source Limitations: Obtain primary terrazzo materials from single source from single manufacturer.
- C. Provide secondary materials including patching and fill material, joint sealant, and repair materials of type and from source recommended by manufacturer of primary materials.
- D. Source Limitations for Aggregates: Obtain each color, grade, type, and variety of granular materials from single source with resources to provide materials of consistent quality in appearance and physical properties.
- E. Mockups: Build mockups to verify selections made under Sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.
 1. Build mockups for terrazzo including accessories.
 - a. Size: Minimum 100 sq. ft. of typical poured-in-place flooring and base condition for each color and pattern in locations directed by Architect.
 2. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.

1.9 DELIVERY, STORAGE, AND HANDLING

- A. Deliver materials to Project site in supplier's original wrappings and containers, labeled with source's or manufacturer's name, material or product brand name, and lot number if any.
- B. Store materials in their original, undamaged packages and containers, inside a well-ventilated area protected from weather, moisture, soiling, extreme temperatures, and humidity.

1.10 FIELD CONDITIONS

- A. Environmental Limitations: Comply with manufacturer's written instructions for substrate temperature, ambient temperature, moisture, ventilation, and other conditions affecting terrazzo installation.
- B. Field Measurements: Verify actual dimensions of construction contiguous with precast terrazzo by field measurements before fabrication.
- C. Provide permanent lighting or, if permanent lighting is not in place, simulate permanent lighting conditions during terrazzo installation.
- D. Close spaces to traffic during terrazzo application and for not less than 24 hours after application unless manufacturer recommends a longer period.

- E. Control and collect water and dust produced by grinding operations. Protect adjacent construction from detrimental effects of grinding operations.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. NTMA Standards: Comply with NTMA's "Terrazzo Specifications and Design Guide" and with written recommendations for terrazzo type indicated unless more stringent requirements are specified.

2.2 EPOXY-RESIN TERRAZZO

- A. Epoxy-Resin Terrazzo: Comply with NTMA's "Terrazzo Specifications and Design Guide" and manufacturer's written instructions for matrix and aggregate proportions and mixing.

- 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Crossfield Products Corp.
 - b. Doyle Dickerson Terrazzo, Inc.
 - c. Hi-Tek Polymers, Inc.
 - d. Key Resin Company.
 - e. Master Terrazzo Technologies LLC.
 - f. Sherwin-Williams Company, General Polymers.
 - g. Terrazzo & Marble Supply Companies.
- 2. Thickness: 3/8-inch nominal.
- 3. Custom Mix Color and Pattern: Match architect's sample.

- B. Materials:

- 1. Flexible Reinforcing Membrane: Manufacturer's resinous membrane for substrate-crack preparation and reflective-crack reduction.
 - a. Reinforcement: Fiberglass scrim.
- 2. Moisture-Vapor-Emission-Control Membrane: Two-component, high-solids, high-density, low-odor, epoxy-based membrane-forming product produced by epoxy terrazzo manufacturer that reduces moisture emission from concrete substrate to not more than 3 lb of water/1000 sq. ft. in 24 hours.
- 3. Primer: Manufacturer's product recommended for substrate and use indicated.
- 4. Epoxy-Resin Matrix: Manufacturer's standard recommended for use indicated and in color required for mix indicated.
 - a. Physical Properties without Aggregates:

- 1) Hardness: 60 to 85 per ASTM D 2240, Shore D.
- 2) Minimum Tensile Strength: 3000 psi per ASTM D 638 for a 2-inch specimen made using a "C" die per ASTM D 412.
- 3) Minimum Compressive Strength: 10,000 psi per ASTM D 695, Specimen B cylinder.
- 4) Chemical Resistance: No deleterious effects by contaminants listed below after seven-day immersion at room temperature per ASTM D 1308.
 - a) Distilled water.
 - b) Mineral water.
 - c) Isopropanol.
 - d) Ethanol.
 - e) 0.025 percent detergent solution.
 - f) 1.0 percent soap solution.
 - g) 10 percent sodium hydroxide.
 - h) 10 percent hydrochloric acid.
 - i) 30 percent sulfuric acid.
 - j) 5 percent acetic acid.
- b. Physical Properties with Aggregates: For resin blended with Georgia white marble, ground, grouted, and cured per requirements in NTMA's "Terrazzo Specifications and Design Guide"; comply with the following:
 - 1) Flammability: Self-extinguishing, maximum extent of burning 1/4-inch per ASTM D 635.
 - 2) Thermal Coefficient of Linear Expansion: 0.0025 inch/inch per deg F for temperature range of minus 12 to plus 140 deg F per ASTM D 696.
5. Aggregates: Comply with NTMA gradation standards for mix indicated and contain no deleterious or foreign matter.
 - a. Abrasion and Impact Resistance: Less than 40 percent loss per ASTM C 131.
 - b. 24-Hour Absorption Rate: Less than 0.75 percent.
 - c. Dust Content: Less than 1.0 percent by weight.
6. Finishing Grout: Resin based.
- C. Epoxy Resin with Aggregate:
 1. Test Specimens:
 - a. Mix epoxy resin according to manufacturer's recommendations and blend one volume of epoxy resin with 3 volumes of marble aggregate, consisting of:
 - 1) 60 percent No. 1 chip.
 - 2) 40 percent No. 0 chip.

- b. Grind and grout with epoxy resin finished to a nominal 1/4-inch thickness.
 - c. Cure specimens 7 days at 75 deg. F plus / minus 2 deg. and 50 percent plus / minus 2 percent relative humidity.
2. Cured epoxy terrazzo specimens shall nominally meet the following requirements:
 - a. Flammability: Self- extinguishing, extent of burning 1/4 inch maximum according to ASTM D 635.
 - b. Coefficient of Linear Thermal Expansion: 0.000025 inch/inch per deg F for temperature range of minus 12 to plus 140 deg F per ASTM D 696.

2.3 STRIP MATERIALS

- A. Thin-Set Divider Strips: L-type angle in depth required for topping thickness indicated.
 1. Bottom-Section Material: Matching top-section material.
 2. Top-Section Material: White-zinc alloy.
 3. Top-Section Width: 1/8-inch.
 4. Strip Thickness: 16 gage.
 5. Type: "L" strip; 3/8-inch by 1/2-inch.
- B. Control-Joint Strips: Separate, double L-type angles, positioned back to back, that match material and color of divider strips and in depth required for topping thickness indicated.
- C. Accessory Strips: Match divider-strip width, material, and color unless otherwise indicated. Use the following types of accessory strips as required to provide a complete installation:
 1. Edge-bead strips for exposed edges of terrazzo.

2.4 MISCELLANEOUS ACCESSORIES

- A. Anchoring Devices:
 1. Strips: Provide mechanical anchoring devices or adhesives for strip materials as recommended by manufacturer and required for secure attachment to substrate.
 2. Precast Terrazzo: Provide mechanical anchoring devices as recommended by fabricator for proper anchorage and support of units for conditions of installation and support.
- B. Patching and Fill Material: Terrazzo manufacturer's resinous product approved and recommended by manufacturer for application indicated.
- C. Joint Compound: Terrazzo manufacturer's resinous product approved and recommended by manufacturer for application indicated.
- D. Resinous Matrix Terrazzo Cleaner: Chemically neutral cleaner with pH factor between 7 and 10 that is biodegradable, phosphate free, and recommended by sealer manufacturer for use on terrazzo type indicated.

- E. Sealer: Slip- and stain-resistant, penetrating-type sealer that is chemically neutral; does not affect terrazzo color or physical properties; is recommended by sealer manufacturer; and complies with NTMA's "Terrazzo Specifications and Design Guide" for terrazzo type indicated.
 - 1. Surface Friction: Not less than 0.6 according to ASTM D 2047.
 - 2. Acid-Base Properties: With pH factor between 7 and 10.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates and areas, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
- B. Proceed with installation only after unsatisfactory conditions, including levelness tolerances, have been corrected.

3.2 PREPARATION

- A. Clean substrates of substances, including oil, grease, and curing compounds, that might impair terrazzo bond. Provide clean, dry, and neutral substrate for terrazzo application.
- B. Concrete Slabs:
 - 1. Provide sound concrete surfaces free of laitance, glaze, efflorescence, curing compounds, form-release agents, dust, dirt, grease, oil, and other contaminants incompatible with terrazzo.
 - a. Shot-blast surfaces with an apparatus that abrades the concrete surface, contains the dispensed shot within the apparatus, and recirculates the shot by vacuum pickup.
 - b. Repair damaged and deteriorated concrete according to terrazzo manufacturer's written recommendations.
 - c. Use patching and fill material to fill holes and depressions in substrates according to terrazzo manufacturer's written instructions.
- C. Verify that concrete substrates are dry and moisture-vapor emissions are within acceptable levels according to manufacturer's written instructions.
 - 1. Moisture Testing: Perform tests indicated below.
 - a. In-Situ Probe Test: Perform relative-humidity test using in-situ probes per ASTM F 2170. Proceed with installation only after substrates have a maximum 75 percent relative-humidity-level measurement.

- D. Protect other work from water and dust generated by grinding operations. Control water and dust to comply with environmental protection regulations.
 - 1. Erect and maintain temporary enclosures and other suitable methods to limit water damage and dust migration and to ensure adequate ambient temperatures and ventilation conditions during installation.

3.3 EPOXY-RESIN TERRAZZO INSTALLATION

- A. Comply with NTMA's written recommendations for terrazzo and accessory installation.
- B. Place, rough grind, grout, cure grout, fine grind, and finish terrazzo according to manufacturer's written instructions and NTMA's "Terrazzo Specifications and Design Guide."
- C. Installation Tolerance: Limit variation in terrazzo surface from level to 1/4 inch in 10 feet; noncumulative.
- D. Ensure that matrix components and fluids from grinding operations do not stain terrazzo by reacting with divider and control-joint strips.
- E. Delay fine grinding until heavy trade work is complete and construction traffic through area is restricted.
- F. Flexible Reinforcing Membrane:
 - 1. Prepare and prefill substrate cracks with membrane material.
 - 2. Install membrane at substrate cracks in areas to receive terrazzo.
 - 3. Reinforce membrane with fiberglass scrim.
 - 4. Prepare membrane according to manufacturer's written instructions before applying substrate primer.
- G. Primer: Apply to terrazzo substrates according to manufacturer's written instructions.
- H. Strip Materials:
 - 1. Divider and Control-Joint Strips:
 - a. Locate divider strips in locations indicated.
 - b. Install control-joint strips back to back directly above concrete-slab control joints.
 - c. Install control-joint strips with 1/8-inch gap between strips, and install sealant in gap.
 - d. Install strips in adhesive setting bed without voids below strips, or mechanically anchor strips as required to attach strips to substrate, as recommended by strip manufacturer.
 - 2. Accessory Strips: Install as required to provide a complete installation.
 - 3. Abrasive Strips: Install with surface of abrasive strip positioned 1/16 inch higher than terrazzo surface.

3.4 REPAIR

- A. Cut out and replace terrazzo areas that evidence lack of bond with substrate. Cut out terrazzo areas in panels defined by strips and replace to match adjacent terrazzo, or repair panels according to NTMA's written recommendations, as approved by Architect.

3.5 CLEANING AND PROTECTION

- A. Cleaning:
 - 1. Remove grinding dust from installation and adjacent areas.
 - 2. Wash surfaces with cleaner according to NTMA's written recommendations and manufacturer's written instructions; rinse surfaces with water and allow them to dry thoroughly.
- B. Not Used
- C. Protection: Provide final protection and maintain conditions, in a manner acceptable to Installer, that ensure that terrazzo is without damage or deterioration at time of Substantial Completion.

END OF SECTION 096623

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SECTION 105113 - METAL LOCKERS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section includes:
 - 1. All welded, heavy-duty metal lockers.
- B. Related Requirements:
 - 1. Section 033000 - "Cast-In-Place Concrete" for the cast-in-place concrete a locker base.
 - 2. Section 042200 - "Concrete Unit Masonry" for locker attachment to this wall type.

1.3 SUBMITTALS

- A. Product Data: For each type of product indicated. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for each type of metal locker.
- B. Shop Drawings: For metal lockers. Include plans, elevations, sections, details, and attachments to other work.
 - 1. Show locker trim and accessories.
 - 2. Include locker identification system and numbering sequence.
- C. Samples: Manufacturer standard colors.
- D. Qualification Data: For qualified Installer.
- E. Maintenance Data: For adjusting, repairing, and replacing locker doors and latching mechanisms to include in maintenance manuals.
- F. Warranty: Sample of special warranty.

1.3 QUALITY ASSURANCE

- A. Installer Qualifications: Manufacturer's authorized representative who is trained and approved for installation of units required for this Project.

- B. Source Limitations: Obtain metal lockers and accessories from single source from single manufacturer.
- C. Regulatory Requirements: Where metal lockers are indicated to comply with accessibility requirements, comply with the U.S. Architectural & Transportation Barriers Compliance Board's "Americans with Disabilities Act (ADA).
- D. Pre-installation Conference: Conduct conference at Project site.

1.4 DELIVERY, STORAGE, AND HANDLING

- A. Do not deliver metal lockers until spaces to receive them are clean, dry, and ready for their installation.

1.5 PROJECT CONDITIONS

- A. Field Measurements: Verify actual dimensions of recessed openings by field measurements before fabrication.

1.6 COORDINATION

- A. Coordinate sizes and locations of concrete base for metal lockers and coordinate locker installation on concrete benches.
- B. Coordinate sizes and locations of framing, blocking, furring, reinforcements, and other related units of work specified in other Sections to ensure that metal lockers can be supported and installed as indicated.

1.7 WARRANTY

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of metal lockers that fail in materials or workmanship, excluding finish, within specified warranty period.
 - 1. Failures include, but are not limited to, structural failures and faulty operation of latches and other door hardware.
 - 2. Damage from deliberate destruction and vandalism is excluded.
 - 3. Warranty Period for All-Welded Metal Lockers: Ten (10) years from date of Substantial Completion.

1.8 EXTRA MATERIALS

- A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Metal locker hooks equal to 5 percent of amount installed for each type and finish installed, but no fewer than 10.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Cold-Rolled Steel Sheet: ASTM A 1008/A 1008M, Commercial Steel (CS), Type B, suitable for exposed applications.
- B. Fasteners: Zinc- or nickel-plated steel, slotless-type, exposed bolt heads; with self-locking nuts or lock washers for nuts on moving parts.
- C. Anchors: Material, type, and size required for secure anchorage to each substrate.
 1. Provide nonferrous-metal or hot-dip galvanized anchors and inserts for corrosion resistance.
 2. Provide toothed-steel or lead expansion sleeves for drilled-in-place anchors.

2.2 HEAVY-DUTY METAL LOCKERS

- A. Products: Subject to compliance with requirements, provide one of the following:
 1. DeBourgh Mfg. Co.; Sentry Corridor/Personnel Lockers.
 2. List Industries Inc.; Marquis Protector.
 3. Lyon Workspace Products, LLC; All-Welded Lockers.
 4. Penco Products, Inc.; All-Welded Lockers.
 5. Republic Storage Systems company, Inc.
 6. Lockers Manufacturing.
- B. Single-Tier Locker Unit Size: **(Type 1)**.
 1. Locker Width: 12-inches.
 2. Locker Depth: 12-inches.
 3. Locker Height: 72-inches.
 4. Overall Unit Height: 72-inches.
 5. Locker Base: 4-inch concrete.
 6. Location: Refer to drawings.
- C. Double-Tier Locker Unit Size: **(Type 2)**.
 1. Locker Width: 12-inches.
 2. Locker Depth: 12-inches.
 3. Locker Height: 36-inches.
 4. Overall Unit Height: 72-inches.
 5. Locker Base: 4-inch concrete.
 6. Location: Refer to drawings.

- D. Six-Tier Locker Unit Size: **(Type 3)**.
1. Locker Width: 12-inches.
 2. Locker Depth: 12-inches.
 3. Locker Height: 12-inches.
 4. Overall Unit Height: 72-inches.
 5. Locker Base: 4-inch concrete.
 6. Location: Refer to drawings.
- E. Material: Cold-rolled steel sheet.
- F. Body: Assembled by welding body components together. Fabricate from unperforated steel sheet with thicknesses as follows:
1. Tops, Bottoms, and Sides: 0.060-inch nominal thickness.
 2. Backs: 0.048-inch nominal thickness.
 3. Shelves: 0.060-inch nominal thickness, with double bend at front and single bend at sides and back.
- G. Frames: Channel formed; fabricated from 0.060-inch nominal-thickness steel sheet; lapped and factory welded at corners; with top and bottom main frames factory welded into vertical main frames. Form continuous, integral door strike full height on vertical main frames.
1. Cross Frames between Tiers: Channel formed and fabricated from same material as main frames; welded to vertical main frames.
- H. Doors: One piece; fabricated from 0.075-inch nominal-thickness steel sheet; formed into channel shape with double bend at vertical edges and with right-angle single bend at horizontal edges.
1. Door Style:
 - a. Louvered Vents: No fewer than three louver openings at top and bottom for double-tier lockers.
 - b. Security Vents: Manufacturer's standard, stamped horizontal or vertical.
- I. Hinges: Welded to door and attached to door frame with no fewer than two factory-installed rivets per hinge that are completely concealed and tamper resistant when door is closed; fabricated to swing 180 degrees.
1. Knuckle Hinges: Steel, full loop, five or seven knuckles, tight pin; minimum 2-inches high. Provide no fewer than three hinges for each door more than 42-inches high.
 2. Continuous Hinges: Manufacturer's standard, steel, full height.
- J. Recessed Door Handle and Latch: Stainless-steel cup with integral door pull, recessed so locking device does not protrude beyond face of door; pry and vandal resistant.

1. Single-Point Latching: Nonmoving latch hook with steel padlock loop that projects through recessed cup and is finished to match metal locker body.
 - a. Latch Hook: Equip each door with one latch hook, fabricated from 0.120-inch nominal-thickness steel sheet; welded midway up full-height door strike; with resilient silencer.
 - K. Combination Padlocks: Provided by Owner.
 - L. Cylinder Locks: Visitor Lockers located off Waiting B1002 will be keyed cylinder locks. Provide five (5) keys per locker to be kept at Master Control.
 - M. Equipment: Equip each metal locker with identification plate and the following unless otherwise indicated:
 1. Single and Double-Tier Units: One double-prong ceiling hook and two single-prong wall hooks.
 2. Hooks shall have a minimum 20 lb. capacity.
 - N. Accessories:
 1. Continuous Sloping Tops: Fabricated from 0.048-inch nominal-thickness steel sheet, with a pitch of approximately 20 degrees.
 - a. Closures: Vertical end type.
 2. Recess Trim: Fabricated from 0.048 inch-nominal-thickness steel sheet.
 3. Filler Panels: Fabricated from 0.048 inch-nominal-thickness steel sheet.
 4. Boxed End Panels: Fabricated from 0.048-inch nominal-thickness steel sheet.
 - O. Finish: Baked enamel.
 1. Color(s): As selected by Architect from manufacturer's full range.
- 2.3 BENCHES:
- A. Bench Tops:
 1. Material: Laminated Harwood with rounded corners.
 2. Thickness: 1-1/4-inches.
 3. Width: 10-inches.
 4. Lengths: 30-inches.
 - B. Bench Pedestals:
 1. Material: Steel Tubing with 10 gage steel flanges.
 2. Height: 16-1/4-inches.
 3. Finish: Match lockers.

2.3 MATERIALS:

- A. Cold-rolled Steel Sheet: ASTM A 1008/A 1008M, Commercial Steel (CS), Type B, suitable for exposed applications.
- B. Fasteners: Zinc-or-nickel-plated steel, slotless-type, exposed bolt heads; with self-locking nuts or lock washers for nuts on moving parts.
- C. Anchors: Material, type, and size required for secure anchorage to each substrate.
 - 1. Provide nonferrous-metal or hot-dip galvanized anchors and inserts for corrosion resistance.
 - 2. Provide toothed-steel or lead expansion sleeves for drilled-in-place anchors.
- D. Finish: Textured (Standard).
 - 1. Powder Coat: Provide factory applied electrostatic powder coat paint. Meet or exceed specifications of the ASTM Standards.
 - 2. Color: As selected by Architect from manufacturer's full range.

2.4 FABRICATION

- A. Fabricate metal lockers square, rigid, and without warp and with metal faces flat and free of dents or distortion. Make exposed metal edges safe to touch and free of sharp edges and burrs.
 - 1. Form body panels, doors, shelves, and accessories from one-piece steel sheet unless otherwise indicated.
 - 2. Provide fasteners, filler plates, supports, clips, and closures as required for complete installation.
- B. Fabricate each metal locker with an individual door and frame; individual top, bottom, and back; and common intermediate uprights separating compartments. Factory weld frame members of each metal locker together to form a rigid, one-piece assembly.
- C. All-Welded Construction: Factory pre-assemble metal lockers by welding all joints, seams, and connections; with no bolts, nuts, screws, or rivets used in assembly of main locker groups. Factory-weld main locker groups into one-piece structures. Grind exposed welds flush.
- D. Hooks: Manufacturer's standard ball-pointed type, aluminum or steel; zinc plated.
- E. Identification Plates: Manufacturer's standard, etched, embossed, or stamped aluminum plates, with numbers and letters at least 3/8-inch high. Each room will have a separate numbering system such as A1 thru A80, B1 thru B20, C1 thru C20, etc. Exact numbering to be finalized by Architect.
- F. Continuous Sloping Tops: Fabricated in lengths as long as practical, without visible fasteners at splice locations; finished to match lockers.

1. Sloping-top corner fillers, mitered.

- G. Recess Trim: Fabricated with minimum 2-1/2-inch face width and in lengths as long as practical; finished to match lockers.
- H. Filler Panels: Fabricated in an unequal leg angle shape; finished to match lockers. Provide slip-joint filler angle formed to receive filler panel. Provide filler panel over columns.
- I. Finished End Panels: Designed for concealing unused penetrations and fasteners, except for perimeter fasteners, at exposed ends of non-recessed metal lockers; finished to match lockers.
- J. Center Dividers: Full-depth, vertical partitions between bottom and shelf; finished to match lockers.

2.5 STEEL SHEET FINISHES

- A. Factory finish steel surfaces and accessories except stainless-steel and chrome-plated surfaces.
- B. Baked-Enamel Finish: Immediately after cleaning, pre-treating, and phosphatizing, apply manufacturer's standard thermosetting baked-enamel finish. Comply with paint manufacturer's written instructions for application, baking, and minimum dry film thickness.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine walls, floors, concrete benches and concrete bases, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
- B. Prepare written report, endorsed by Installer, listing conditions detrimental to performance of the Work.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. General: Install level, plumb, and true; shim as required, using concealed shims.
 - 1. Anchor locker runs at ends and at intervals recommended by manufacturer, but not more than 36-inches o.c. Using concealed fasteners, install anchors through backup reinforcing plates, channels, or blocking as required to prevent metal distortion.
 - 2. Anchor single rows of metal lockers to walls near top and bottom of lockers.
 - 3. Anchor back-to-back metal lockers to concrete base/floor.

- B. All-Welded Metal Lockers: Connect groups together with standard fasteners, with no exposed fasteners on face frames.
- C. Equipment and Accessories: Fit exposed connections of trim, fillers, and closures accurately together to form tight, hairline joints, with concealed fasteners and splice plates.
 - 1. Attach hooks with at least two fasteners.
 - 2. Attach door locks on doors using security-type fasteners.
 - 3. Identification Plates: Identify metal lockers with identification.
 - a. Attach plates to each locker door, near top, centered, with at least two aluminum rivets.
 - 4. Attach recess trim to recessed metal lockers with concealed clips.
 - 5. Attach filler panels with concealed fasteners. Locate filler panels where indicated on Drawings or as required.
 - 6. Attach sloping-top units to metal lockers, with closures at exposed ends.
 - 7. Attach finished end panels with fasteners only at perimeter to conceal exposed ends of non-recessed metal lockers.

3.3 ADJUSTING, CLEANING, AND PROTECTION

- A. Clean, lubricate, and adjust hardware. Adjust doors and latches to operate easily without binding.
- B. Protect metal lockers from damage, abuse, dust, dirt, stain, or paint. Do not permit use during construction.
- C. Touch up marred finishes or replace metal lockers that cannot be restored to factory-finished appearance. Use only materials and procedures recommended or furnished by locker manufacturer.

END OF SECTION 105113

SECTION 111800 – SECURITY EQUIPMENT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:
 - 1. Speak-thru and deal tray.
- B. Related Sections:
 - 1. Section 050553 – “Security Metal Fastenings” for anchoring or attaching building elements, furniture, equipment and fixtures within the secure perimeter.
 - 2. Section 088000 - “Glazing” for glass types speak-thrus will be mounted in.
 - 3. Section 088853 - “Security Glazing” for security glass types speak-thrus will be mounted in.
 - 4. Section 123661 - "Solid Surfacing Countertops" for counters deal trays will be mounted in.

1.3 SUBMITTALS

- A. Product Data: For each type of product indicated. Include rated capacities, construction details, material descriptions, dimensions of individual components and profiles, and finishes for security equipment.
- B. Product Schedule: Indicating types, quantities, sizes, and installation locations by room of each security equipment item required.
 - 1. Identify locations using room designations indicated.
 - 2. Identify products using designations indicated.
- C. Samples for Verification: For each type of exposed finish required.
- D. Maintenance Data: For security equipment to include in maintenance manuals.

1.4 QUALITY ASSURANCE

- A. Source Limitations: For products listed together in the same Part 2 articles, obtain products from single source from single manufacturer.

1.5 COORDINATION

- A. Coordinate sizes and locations of mounting holes, blocking and backing required for installation of security equipment.

PART 2 - PRODUCTS

2.1 Not Used

- A. Not Used
- B. Not Used
- C. Deal Tray:
 - 1. Pass-Thru Size: 8-inches x 11-1/2-inches x 2-inches deep.
 - 2. Material: Stainless-steel.
 - 3. Stainless-Steel flip lid built into deal tray (mounted on the internal tray area to reduce noise transmission.
- D. Speak Thru:
 - 1. Size: Nominal 6-inches.
 - 2. Bullet Resistance: Level III.
 - 3. Adjustable to accommodate .25-inch to 1.875-inch thick glazing.

2.2 MATERIALS

- A. Die-Cast Aluminum: ASTM B 85, manufacturer's standard aluminum alloy.
- B. Stainless-Steel Sheet, Strip, and Plate: ASTM A 240/A 240M or ASTM A 666, Type 304.
- C. Stainless-Steel Bolts and Nuts: Annealed stainless-steel bolts, ASTM F 593 (ASTM F 738M); with hex nuts, ASTM F 594 (ASTM F 836M); and, where indicated, flat washers; Alloy Group 1 (A1)

2.3 FABRICATION

- A. Form security equipment to required shapes and sizes, with true lines and angles, square, rigid, and without warp, and with metal faces free of dents or distortion. Make exposed metal edges and corners free of sharp edges and burrs and safe to touch.
- B. Preassemble security equipment in shop to greatest extent possible to minimize field assembly.

- C. Mill joints to a tight, hairline fit.
- D. Drill or punch holes required for fasteners and remove burrs. Use security fasteners where fasteners are exposed.
- E. Where dissimilar metals will contact each other, protect against galvanic action by painting contact surfaces with bituminous coating or by applying other permanent separation as recommended by manufacturers of dissimilar metals.

2.4 GENERAL FINISH REQUIREMENTS

- A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
- B. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.
- C. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.
- D. Stainless-Steel Finish: No. 4 bright, directional polish on exposed faces.
- E. Aluminum Finish: Anodic Finish: Clear satin.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Examine areas, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
- B. Examine substrates to which security equipment will be attached for properly located holes, blocking, grounds, or other solid backing for attachment of support fasteners.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Install security equipment level, plumb, square, rigid, true. Make connections to form a rigid structure, free of buckling and warping.
 - 1. Install exposed connections with hairline joints, flush and smooth, using concealed fasteners where possible.
 - 2. Install braces, straps, plates, brackets, and other reinforcements as needed to support shelf loading and as required for stability.

3.3 ADJUSTING, CLEANING, AND PROTECTION

- A. Remove temporary protective coverings and strippable films, if any, as security equipment is installed unless otherwise indicated in manufacturers written installation instructions.
- B. Touch up marred finishes or replace security equipment that cannot be restored to factory-finished appearance. Use only materials and procedures recommended or furnished by security equipment manufacturer.
- C. Replace security equipment that have been damaged or have deteriorated beyond successful repair by finish touchup or similar minor repair procedures.
- D. On completion of equipment installation, clean surfaces as recommended by manufacturer.

END OF SECTION 111800

SECTION 115313 - LABORATORY FUME HOODS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:

- 1. Bench-top laboratory fume hood in Evidence Processing C1047.
 - 2. Fume hood base cabinets.

- B. Related Requirements:

- 1. Section 061053 - "Miscellaneous Rough Carpentry" for wood blocking for anchoring fume hoods.
 - 2. Section 092216 "Non-Structural Metal Framing" for reinforcements in metal-framed partitions for anchoring fume hoods.
 - 3. Section 096513 "Resilient Base and Accessories" for resilient base applied to fume hood base cabinets.
 - 4. Section 230593 "Testing, Adjusting, and Balancing for HVAC" for field quality-control testing of fume hoods.
 - 5. Section 230923 "Direct Digital Control (DDC) System for HVAC" for VAV controls for fume hood exhaust.

1.3 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site.

1.4 COORDINATION

- A. Coordinate layout and installation of framing and reinforcements for lateral support of fume hoods.
- B. Coordinate installation of fume hoods with laboratory casework and other laboratory equipment.

1.5 ACTION SUBMITTALS

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

- B. Shop Drawings: For laboratory fume hoods.
 - 1. Include plans, elevations, sections, and attachment details.
 - 2. Indicate details for anchoring fume hoods to permanent building construction including locations of blocking and other supports.
 - 3. Indicate locations and types of service fittings together with associated service supply connection required.
 - 4. Indicate duct connections, electrical connections, and locations of access panels.
 - 5. Include roughing-in information for mechanical, plumbing, and electrical connections.
 - 6. Show adjacent walls, doors, windows, other building components, laboratory casework, and other laboratory equipment. Indicate clearances from the above items.
 - 7. Include layout of fume hoods in relation to lighting fixtures and air-conditioning registers and grilles.
 - 8. Include coordinated dimensions for laboratory equipment specified in other Sections.
- C. Delegated-Design Submittal: For fume hoods indicated to comply with seismic performance requirements and design criteria.

1.6 INFORMATIONAL SUBMITTALS

- A. Product Test Reports: Showing compliance with specified performance requirements for as-manufactured containment and static pressure loss, based on evaluation of comprehensive tests performed by manufacturer and witnessed by a qualified testing agency.
- B. Source quality-control reports.
- C. Field quality-control reports.

1.7 MAINTENANCE MATERIAL SUBMITTALS

- A. Furnish complete touchup kit for each type and color of fume hood finish provided. Include fillers, primers, paints, and other materials necessary to perform permanent repairs to damaged fume hood finish.

1.8 DELIVERY, STORAGE, AND HANDLING

- A. Protect finished surfaces during handling and installation with protective covering of polyethylene film or another suitable material.

1.9 FIELD CONDITIONS

- A. Environmental Limitations: Do not deliver or install fume hoods until building is enclosed, wet work and utility roughing-in are complete, and HVAC system is operating and maintaining temperature and relative humidity at occupancy levels during the remainder of the construction period.

- B. Locate concealed framing, blocking, and reinforcements that support fume hoods by field measurements before being enclosed, and indicate measurements on Shop Drawings.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Bypass Fume Hoods with Steel Exterior:

- 1. Manufacturers: Subject to compliance with requirements, provide a 48-inch basic laboratory hood with integral blower by one of the following:
 - a. Air Master Systems Corporation.
 - b. Bedcolab Ltd.
 - c. BMC Manufacturing.
 - d. Cole-Parmer.
 - e. Hanson Lab Solutions.
 - f. Iroquois Hoods.
 - g. Jamestown Metal Products.
 - h. Keur Industries, Inc.
 - i. Kewaunee Scientific Corporation.
 - j. Lab Crafters, Inc.
 - k. Lab Fabricators.
 - l. Labconco Corporation.
 - m. Laboratory Equipment Manufacturers, LLC.

- B. Product Designations: Drawings indicate sizes, types, and configurations of fume hoods by referencing designated manufacturer's catalog numbers. Other manufacturers' fume hoods of similar sizes, types, and configurations, and complying with the Specifications, may be considered. See Section 016000 "Product Requirements."

- C. Dimensions: 48-inches wide by 26-inches depth.

D. Power Requirements:

- 1. Power (PAC): 115 volts.
- 2. Power (Hz): 60.

- E. Blower Motor: 1/3 HP.

2.2 PERFORMANCE REQUIREMENTS

- A. Containment: Provide fume hoods that comply with the following when tested according to ASHRAE 110:

- 1. Average Face Velocity: 100 fpm plus or minus 10 percent with sashes fully open.

2. 4 ft. Hood Face-Velocity 100 fpm Sash at 18-inches Open: Shall not exceed 440 CFM @ 0.10-inches.
 3. 4 ft. Hood Face-Velocity 100 fpm Sash at 28-inches Open: Shall not exceed 705 CFM @ 0.26-inches.
- B. Static-Pressure Loss: Not more than 1/2-inch wg at 100-fpm face velocity with sash fully open when measured at four locations 90 degrees apart around the exhaust duct and at least three duct diameters downstream from duct collar.
- C. Delegated Design: Engage a qualified professional engineer, as defined in Section 014000 "Quality Requirements," to design fume hoods for seismic performance.
- D. Seismic Performance: Fume hoods, including attachments to other work, shall withstand the effects of earthquake motions determined according to ASCE/SEI 7.

2.3 FUME HOODS

- A. Product Standards: Comply with SEFA 1, "Laboratory Fume Hoods - Recommended Practices." Provide fume hoods UL listed and labeled for compliance with UL 1805.
- B. Bypass Fume Hoods: Provide bypass fume hoods. Compensating bypass above the sash opens as sash is closed. Provide sufficient bypass capacity so that face velocity with sash opening of 6 inches does not exceed 3 times the face velocity with sash fully open.

2.4 MATERIALS

- A. Steel Sheet: Cold-rolled, commercial steel (CS) sheet, complying with ASTM A1008/A1008M; matte finish; suitable for exposed applications.
1. Side panels and access panels 20-gage (or heavier) sheet steel.
 2. Hood corner posts are 18-gage sheet steel.
 3. Ceiling enclosure panels are 18 gage sheet steel.
- B. Glass-Fiber-Reinforced Polyester: Polyester laminate with a chemical-resistant gel coat on exposed faces, and having a flame-spread index of 25 or less according to ASTM E84.
- C. Epoxy: Factory molded, modified epoxy-resin formulation with smooth, non-specular finish.
1. Physical Properties:
 - a. Flexural Strength: Not less than 10,000 psi (70 MPa).
 - b. Modulus of Elasticity: Not less than 2,000,000 psi (1400 MPa).
 - c. Hardness (Rockwell M): Not less than 100.
 - d. Water Absorption (24 Hours): Not more than 0.02 percent.
 - e. Heat Distortion Point: Not less than 260 deg F (127 deg C).
 - f. Flame-Spread Index: 25 or less according to ASTM E84.

2. Chemical Resistance: As follows when tested with indicated reagents according to NEMA LD 3, Test Procedure 3.4.5:
 - a. No Effect: Acetic acid (98 percent), acetone, ammonium hydroxide (28 percent), benzene, carbon tetrachloride, dimethyl formamide, ethyl acetate, ethyl alcohol, ethyl ether, methyl alcohol, nitric acid (70 percent), phenol, sulfuric acid (60 percent), and toluene.
 - b. Slight Effect: Chromic acid (60 percent) and sodium hydroxide (50 percent).
 3. Color: As selected by Architect from manufacturer's full range.
- D. Polypropylene: Unreinforced polypropylene complying with ASTM D4101, Group 01, Class 1, Grade 2.
- E. Glass: Clear, laminated tempered glass complying with ASTM C1172, Kind LT, Condition A, Type I, Class I, Quality-Q3; 3/16-inches thick and with clear, polyvinyl butyral interlayer.
- F. 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.
- G. Fasteners: Provide stainless steel fasteners where exposed to fumes.

2.5 FABRICATION

- A. General: Assemble fume hoods in factory to greatest extent possible. Disassemble fume hoods only as necessary for shipping and handling limitations. Fume hoods shall be capable of being partly disassembled as necessary to permit movement through a 35-by-79-inch door opening.
- B. Steel Exterior: Fabricate from steel sheet, 0.048-inch thick, with component parts screwed together to allow removal of end panels, front fascia, and airfoil and to allow access to plumbing lines and service fittings. Apply chemical-resistant finish to interior and exterior surfaces of component parts before assembly.
- C. Ends: Fabricate with double-wall end panels without projecting corner posts or other obstructions to interfere with smooth, even airflow. Close area between double walls at front of fume hood and as needed to house sash counterbalance weights, utility lines, and remote-control valves.
- D. Splay top and sides of face opening to provide an aerodynamic shape to ensure smooth, even flow of air into fume hood.
- E. Interior Lining: Provide the following unless otherwise indicated:
1. Durable powder-coated 16 gage steel liner.
- F. Lining Assembly: Unless otherwise indicated, assemble with stainless steel fasteners or epoxy adhesive, concealed where possible. Seal joints by filling with chemical-resistant sealant during assembly.

1. Punch fume hood lining side panels to receive service fittings and remote controls. Delete "Rear Baffle" Paragraph below if only molded glass-fiber-reinforced polyester linings are used, because they include integral rear baffle.
 - G. Rear Baffle: Unless otherwise indicated, provide baffle, of same material as fume hood lining, at rear of hood with openings at top and bottom. Secure baffle to cleats at rear of hood with stainless steel screws. Fabricate baffle for easy removal for cleaning behind baffle.
 1. Provide two-piece adjustable baffles.
 - H. Exhaust Plenum: Full width of fume hood and with adequate volume to provide uniform airflow from hood, of same material as hood lining, and with duct stub for exhaust connection.
 - I. Bypass Grilles: Provide grilles at bypass openings of fume hoods.
 - J. Sashes: Provide operable sashes of type indicated.
 1. Fabricate from 0.048-inch- thick steel sheet, with chemical-resistant finish. Form into four-sided frame with bottom corners welded and finished smooth. Make top member removable for glazing replacement. Set glazing in chemical-resistant, U-shaped gaskets.
 2. Glaze with laminated safety glass.
 - K. Airfoil: Unless otherwise indicated, provide airfoil at bottom of fume hood face opening with 1-inch space between airfoil and work top. Sash closes on top of airfoil, leaving 1-inch opening for air intake. Airfoil directs airflow across work top to remove heavier-than-air gases and to prevent reverse airflow.
 - L. Light Fixtures: Provide vaporproof, acid-resistant, incandescent light fixtures complete with 100-W, Type A, long-life bulbs instead of fluorescent fixtures at perchloric acid and radioisotope fume hoods.
 - M. Comply with requirements in other Sections for installing water and laboratory gas service fittings, piping, electrical devices, and wiring. Install according to Shop Drawings. Securely anchor fittings, piping, and conduit to fume hoods unless otherwise indicated.
- 2.6 FUME HOOD BASE CABINETS
- A. Comply with Section 123553.13 "Metal Laboratory Casework fume hood exterior finish.
 - B. Work Tops: Stainless steel.
- 2.7 CHEMICAL-RESISTANT FINISH
- A. General: Prepare, treat, and finish welded assemblies after welding. Prepare, treat, and finish components that are to be assembled with mechanical fasteners before assembling. Prepare, treat, and finish concealed surfaces same as exposed surfaces.

- B. Preparation: Clean steel surfaces, other than stainless steel, of mill scale, rust, oil, and other contaminants. After cleaning, apply a conversion coating suited to the organic coating to be applied over it.
- C. Chemical-Resistant Finish: Immediately after cleaning and pretreating, apply fume hood manufacturer's standard two-coat, chemical-resistant, baked-on finish consisting of prime coat and thermosetting topcoat. Comply with coating manufacturer's written instructions for applying and baking to achieve a minimum dry film thickness of 2 mils.
 - 1. Chemical and Physical Resistance of Finish System: Finish complies with acceptance levels of cabinet surface finish tests in SEFA 8M. Acceptance level for chemical spot test shall be no more than four Level 3 conditions.
 - 2. Colors for Fume Hood Finish: As selected by Architect from manufacturer's full range.

2.8 ACCESSORIES

- A. Airflow Indicator and Alarm: Provide fume hood with manufacturer's standard airflow indicator with audible and visual alarm that activates when airflow sensor reading is outside of preset range.
- B. Sash Alarm: Provide fume hoods with audible and visual alarm that activates when sash is opened beyond preset position.
 - 1. Provide with silence and test switches.

2.9 SOURCE QUALITY CONTROL

- A. Demonstrate fume hood performance before shipment by testing fume hood according to ASHRAE 110 as modified in "Performance Requirements" Article. Provide testing facility, instruments, equipment, and materials needed for tests.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine areas, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of fume hoods.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. General: Install fume hoods according to manufacturer's written instructions. Install level, plumb, and true; shim as required, using concealed shims, and securely anchor to building and adjacent laboratory casework.

Securely attach access panels but provide for easy removal and secure reattachment. Where fume hoods abut other finished work, apply filler strips and scribe for accurate fit, with fasteners concealed where practical.

- B. Comply with requirements in Section 123553.13 "Metal Laboratory Casework" for installing fume hood base cabinets, work tops, and sinks.
- C. Comply with requirements for installing water and laboratory gas service fittings and electrical devices.
 - 1. Install fittings according to Shop Drawings, installation requirements in SEFA 2.3, and manufacturer's written instructions. Set bases and flanges of sink and work top-mounted fittings in sealant recommended by manufacturer of sink or work-top material. Securely anchor fittings to fume hoods unless otherwise indicated.

3.3 FIELD QUALITY CONTROL

- A. Field test installed fume hoods according to ASHRAE 110 as modified in "Performance Requirements" Article to verify compliance with performance requirements.
 - 1. Adjust fume hoods, hood exhaust fans, and building's HVAC system, or replace hoods and make other corrections until tested hoods perform as specified.
 - 2. After making corrections, retest fume hoods that failed to perform as specified.

3.4 ADJUSTING AND CLEANING

- A. Adjust moving parts for smooth, near silent, accurate sash operation with one hand. Adjust sashes for uniform contact of rubber bumpers. Verify that counterbalances operate without interference.
- B. Clean finished surfaces, including both sides of glass; touch up as required; and remove or refinish damaged or soiled areas to match original factory finish, as approved by Architect.

END OF SECTION 115313

Section 2.1 SECTION 123553.13 - METAL LABORATORY CASEWORK

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:
 - 1. Metal laboratory casework.
 - 2. Filler and closure panels.
- B. Related Requirements:
 - 1. Section 042200 – “Concrete Unit Masonry” for wall substrate to anchor cabinets.
 - 2. Section 061053 - "Miscellaneous Rough Carpentry" for wood blocking for anchoring laboratory casework.
 - 3. Section 123616 – “Metal Countertops” for countertops with the metal laboratory casework.

1.3 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site.

1.4 COORDINATION

- A. Coordinate layout and installation of framing and reinforcements for support of laboratory casework.
- B. Coordinate installation of laboratory casework with installation of fume hoods and other laboratory equipment.

1.5 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Shop Drawings: For laboratory casework. Include plans, elevations, sections, and attachment details.
 - 1. Indicate types and sizes of cabinets.

2. Indicate locations of hardware.
 3. Indicate locations and types of service fittings.
 4. Indicate locations of blocking and reinforcements required for installing laboratory casework.
 5. Include details of utility spaces showing supports for conduits and piping.
 6. Include details of support framing system.
 7. Indicate locations of and clearances from adjacent walls, doors, windows, and other building components.
- C. Samples for Initial Selection: For factory-applied finishes and other materials requiring color selection.
- D. Samples for Verification: For each type of cabinet finish and each type of countertop material, in manufacturer's standard sizes.

1.6 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For manufacturer.
- B. Product Test Reports for Countertop Surface Material: Based on evaluation of comprehensive tests performed by a qualified testing agency, indicating compliance of laboratory countertop surface materials with requirements specified for chemical and physical resistance.

1.7 MAINTENANCE MATERIAL SUBMITTALS

- A. Furnish complete touchup kit for each type and color of metal laboratory casework provided. Include fillers, primers, paints, and other materials necessary to perform permanent repairs to damaged laboratory casework finish.
- B. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
1. Cabinet Mounting Clips and Related Hardware: Quantity equal to 5 percent of amount installed, but no fewer than 20 of each type.
 2. Modular Countertop Units: Two extra units of each length and material installed.

1.8 QUALITY ASSURANCE

- A. Manufacturer Qualifications: A qualified manufacturer that produces casework of types indicated for this Project that has been tested for compliance with SEFA 8 M.

1.9 DELIVERY, STORAGE, AND HANDLING

- A. Protect finished surfaces during handling and installation with protective covering of polyethylene film or other suitable material.

1.10 FIELD CONDITIONS

- A. Environmental Limitations: Do not deliver or install laboratory casework until building is enclosed, utility roughing-in and wet work are complete and dry, and temporary HVAC system is operating and maintaining temperature and relative humidity at occupancy levels during the remainder of the construction period.
- B. Locate concealed framing, blocking, and reinforcements that support casework by field measurements before being enclosed, and indicate measurements on Shop Drawings.

1.11 WARRANTY

- A. Warranty Period: One (1) year after Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Basis-of-Design Product: Subject to compliance with requirements, provide "HLF Steel Casework" as manufactured by Hanson Lab Furniture, Inc." or a comparable product by one of the following:
 - 1. Bedcolab Ltd.
 - 2. BMC Manufacturing.
 - 3. Hamilton Laboratory Solutions (model numbers referenced on drawings).
 - 4. Kewaunee Scientific Corporation.
 - 5. Lab Crafters, Inc.
 - 6. Lab Fabricators.
 - 7. Mott Manufacturing Ltd.
 - 8. Air Master Systems Corp.
- B. Source Limitations: Obtain laboratory casework from single source from single manufacturer unless otherwise indicated.

2.2 PERFORMANCE REQUIREMENTS

- A. System Structural Performance: Laboratory casework and support framing system shall withstand the effects of the following gravity loads and stresses without permanent deformation, excessive deflection, or binding of drawers and doors:
 - 1. Wall Cabinets (Upper Cabinets): 160 lb/ft.
 - 2. Shelves: 40 lb/sq. ft.

2.3 CASEWORK, GENERAL

- A. Casework Product Standard: Comply with SEFA 8 M, "Laboratory Grade Metal Casework."
- B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

2.4 METAL CABINET MATERIALS

- A. Metal: Cold-rolled, commercial steel (CS) sheet, complying with ASTM A 1008/A 1008M; matte finish; suitable for exposed applications.
- B. Nominal Metal Thickness:
 - 1. Sides, Ends, Fixed Backs, Bottoms, Tops, Soffits, and Items Not Otherwise Indicated: 0.048-inch.
 - 2. Back Panels, Doors, Drawer Fronts and Bodies, and Shelves: 0.036-inch except 0.048-inch for back panels and doors of flammable liquid storage cabinets and for unreinforced shelves more than 36-inches long.
 - 3. Intermediate Horizontal Rails, Table Aprons and Cross Rails, Center Posts, and Top Gussets: 0.060-inch.
 - 4. Drawer Runners, Sink Supports, and Hinge Reinforcements: 0.075-inch.
 - 5. Leveling and Corner Gussets: 0.105-inch.
- C. Cabinet Types:
 - 1. Base cabinets.
 - 2. Upper cabinets.
 - 3. Full height cabinets.
- D. Sizes: Refer to drawings.

2.5 METAL CABINETS

- A. Fabrication: Assemble and finish units at point of manufacture. Use precision dies for interchangeability of like-size drawers, doors, and similar parts. Perform assembly on precision jigs to provide units that are square. Reinforce units with angles, gussets, and channels. Except where otherwise specified, integrally frame and weld cabinet bodies to form dirt- and vermin-resistant enclosures. Where applicable, reinforce base cabinets for sink support. Maintain uniform clearance around door and drawer fronts of 1/16 to 3/32-inch.
- B. Flush Doors: Outer and inner pans that nest into box formation, with full-height channel reinforcements at center of door. Fill doors with noncombustible, sound-deadening material.
- C. Hinged Doors: Mortise for hinges and reinforce with angles welded inside inner pans at hinge edge.

- D. Drawers: Fronts made from outer and inner pans that nest into box formation, with no raw metal edges at top. Sides, back, and bottom fabricated in one piece with rolled or formed top of sides for stiffening and comfortable grasp for drawer removal.

Provide drawers with rubber bumpers, polymer roller slides, and positive stops to prevent metal-to-metal contact or accidental removal.

- E. Adjustable Shelves: Front, back, and ends formed down, with edges returned horizontally at front and back to form reinforcing channels.
- F. Toe Space: Fully enclosed, 4-inches high by 3-inches deep, with no open gaps or pockets.
- G. Filler and Closure Panels: Provide where indicated and as needed to close spaces between cabinets and walls, ceilings, and indicated equipment. Fabricate from same material and with same finish as cabinets and with hemmed or flanged edges unless otherwise indicated.

2.6 METAL CABINET FINISH

- A. General: Prepare, treat, and finish welded assemblies after assembling. Prepare, treat, and finish components that are to be assembled with mechanical fasteners before assembling. Prepare, treat, and finish concealed surfaces same as exposed surfaces.
- B. Preparation: After assembly, clean surfaces of mill scale, rust, oil, and other contaminants. After cleaning, apply a conversion coating suited to the organic coating to be applied over it.
- C. Chemical-Resistant Finish: Immediately after cleaning and pretreating, apply laboratory casework manufacturer's standard two-coat, chemical-resistant, baked-on finish consisting of prime coat and thermosetting topcoat. Comply with coating manufacturer's written instructions for applying and baking to achieve a minimum dry film thickness of 2 mils.
 - 1. Chemical and Physical Resistance of Finish System: Finish complies with acceptance levels of cabinet surface finish tests in SEFA 8 M. Acceptance level for chemical spot test shall be no more than four Level 3 conditions.
 - 2. Colors for Metal Laboratory Casework Finish: As selected by Architect from manufacturer's full range.

2.7 HARDWARE

- A. General: Provide laboratory casework manufacturer's standard, commercial-quality, heavy-duty hardware complying with requirements indicated for each type.
- B. Hinges: Stainless-steel, five-knuckle hinges complying with BHMA A156.9, Grade 1, with antifriction bearings and rounded tips. Provide two for doors 48 inches high or less and three for doors more than 48-inches high.
- C. Hinged Door and Drawer Pulls: Solid-aluminum, stainless-steel, or chrome-plated-brass, back-mounted pulls. Provide two pulls for drawers more than 24-inches wide.

1. Design: Wire pulls Rectangular loop pulls with rounded corners.
 2. Overall Size: 1 by 4-1/2-inches.
- D. Door Catches: Nylon-roller spring catches. Provide two catches on doors more than 48-inches high.
- E. Drawer Slides: Side mounted, epoxy-coated steel, self-closing; designed to prevent rebound when drawers are closed; complying with BHMA A156.9, Type B05091.
1. Standard Duty (Grade 1): Full-extension type, with polymer rollers.
- F. Locks: Cam or half-mortise type with five-pin tumbler, brass with chrome-plated finish; complying with BHMA A156.11, Type E0728.
- G. Sliding-Door Hardware Sets: Laboratory casework manufacturer's standard, to suit type and size of sliding-door units.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine areas, with Installer present, for compliance with requirements for installation tolerances, location of reinforcements, and other conditions affecting performance of the Work.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION OF CABINETS

- A. Comply with installation requirements in SEFA 2.3. Install level, plumb, and true; shim as required, using concealed shims. Where laboratory casework abuts other finished work, apply filler strips and scribe for accurate fit, with fasteners concealed where practical. Do not exceed the following tolerances:
1. Variation of Tops of Base Cabinets from Level: 1/16-inch in 10 feet.
 2. Variation of Bottoms of Upper Cabinets from Level: 1/8-inch in 10 feet.
 3. Variation of Faces of Cabinets from a True Plane: 1/8-inch in 10 feet.
 4. Variation of Adjacent Surfaces from a True Plane (Lippage): 1/32-inch.
 5. Variation in Alignment of Adjacent Door and Drawer Edges: 1/16-inch.
- B. Utility-Space Framing: Secure to floor with two fasteners at each frame. Fasten to partition framing, wood blocking, or metal reinforcements in partitions and to base cabinets.
- C. Base Cabinets: Fasten cabinets to utility-space framing, partition framing, wood blocking, or reinforcements in partitions, with fasteners spaced not more than 16-inches o.c. Bolt adjacent cabinets together with joints flush, tight, and uniform.

1. Where base cabinets are installed away from walls, fasten to floor at toe space at not more than 24-inches o.c. and at sides of cabinets with not less than two fasteners per side.
- D. Wall Cabinets: Fasten to hanging strips, masonry, partition framing, blocking, or reinforcements in partitions. Fasten each cabinet through back, near top, at not less than 16-inches o.c.
- E. Install hardware uniformly and precisely. Set hinges snug and flat in mortises.
- F. Adjust laboratory casework and hardware so doors and drawers align and operate smoothly without warp or bind and contact points meet accurately. Lubricate operating hardware as recommended by manufacturer.
- G. Remove excess sealant or adhesive while still wet and finish joint for neat appearance.

3.3 CLEANING AND PROTECTING

- A. Clean finished surfaces, touch up as required, and remove or refinish damaged or soiled areas to match original factory finish, as approved by Architect.

END OF SECTION 123553.13

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SECTION 221313 - FACILITY SANITARY SEWERS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:
 - 1. Pipe and fittings.
 - 2. Nonpressure couplings.
 - 3. Cleanouts.
 - 4. Encasement for piping.
 - 5. Manholes.

1.3 DEFINITIONS

- A. FRP: Fiberglass-reinforced plastic.

1.4 ACTION SUBMITTALS

- A. Product Data: For the following:
 - 1. Expansion joints and deflection fittings.
- B. Shop Drawings: For manholes. Include plans, elevations, sections, details, and frames and covers.

1.5 INFORMATIONAL SUBMITTALS

- A. Coordination Drawings: Show pipe sizes, locations, and elevations. Show other piping in same trench and clearances from sewer system piping. Indicate interface and spatial relationship between manholes, piping, and proximate structures.
- B. Product Certificates: For each type of cast-iron soil pipe and fitting, from manufacturer.
- C. Field quality-control reports.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Do not store plastic manholes, pipe, and fittings in direct sunlight.
- B. Protect pipe, pipe fittings, and seals from dirt and damage.
- C. Handle manholes according to manufacturer's written rigging instructions.

1.7 PROJECT CONDITIONS

- A. Interruption of Existing Sanitary Sewerage Service: Do not interrupt service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary service according to requirements indicated:
 - 1. Notify Construction Manager no fewer than two days in advance of proposed interruption of service.
 - 2. Do not proceed with interruption of service without Owner's written permission.

PART 2 - PRODUCTS

2.1 PVC PIPE AND FITTINGS

- A. PVC Gravity Sewer Piping:
 - 1. All sewer pipe shall be manufactured by an experienced and reputable manufacturer whose pipe has been used commercially for at least three (3) years, and shall conform to the applicable specifications and requirements set forth herein.
 - 2. Pipe used in sanitary sewer construction, unless otherwise specified, shall be of PVC.
 - 3. All flexible pipe must meet a minimum deflection test of five percent (5%)
 - 4. PVC Pipe (solid wall): Pipe shall conform to ASTM D3034 for SDR 35 and SDR 26 for 15" diameter and smaller pipe. ASTM F-679, T-1 wall thickness, for pipe larger than 15" diameter.
 - 5. Joints for Sanitary Sewers
 - 1. The PVC joint shall conform to ASTM D3212 or ASTM D-2464. Rubber gaskets shall conform to ASTM F477
 - 6. Fittings
 - 1. PVC sewer fittings shall conform to ASTM D-3034. Fittings shall be molded in one piece, with elastomeric joints. Fittings shall be molded or fabricated from pipe meeting ASTM D-3034 with manufacturer's standard pipe bells and gaskets.

2.2 CLEANOUTS

A. PVC Cleanouts:

1. Description: PVC body with PVC threaded plug. Include PVC sewer pipe fitting and riser to cleanout of same material as sewer piping.
2. The minimum allowable inside diameter for building sewer laterals shall be 6 inches with a slope no less than 1/8 inch per foot.
3. Clean-outs, equal in size to the building sewer lateral shall be required at the following locations:
 - a. The outside junction of all residential and commercial building drains and the building sewer laterals,
 - b. For 6 inch service laterals, every 100 linear foot of sanitary sewer lateral piping, and
 - c. Any Change of direction greater than 45 degrees. Where more than one change of direction occurs in a run of piping, one cleanout shall be required for each change of direction that results in a total deflection of 90 degrees.
 - d. All sanitary service lateral piping and fittings shall be PVC SDR 35, per ASTM D-3034, with gasketed joints, per ASTM D-3212, unless otherwise indicated. Installation of all PVC sanitary pipes shall conform to ASTM D-2321.

2.3 MANHOLES

A. Standard Precast Concrete Manholes:

1. Description: ASTM C 478, precast, reinforced concrete, of depth indicated, with provision for sealant joints, with joints meeting requirements of ASTM C443.
2. Diameter: 48 inches minimum unless otherwise indicated.
3. Joint Sealant: ASTM C 990, bitumen or butyl rubber.
4. Resilient Pipe Connectors: ASTM C 923 (ASTM C 923M), cast or fitted into manhole walls, for each pipe connection. "A-Lok" or approved equal.
5. Steps: Copolymer Polypropylene Plastic Manhole Steps with ½" grade 60 steel reinforcing, by MA Industries, Inc, or approved equal. Cast or anchor steps into sidewalls at 16-inch intervals.
6. Adjusting Rings: Interlocking concrete rings, with level or sloped edge in thickness and diameter matching manhole frame and cover, and with height as required to adjust manhole frame and cover to indicated elevation and slope. Include sealant recommended by ring manufacturer. Maximum allowable adjustment of 6", utilizing 2" minimum spacer rings.

B. Manhole Frames and Covers:

1. Description: Manhole frame and lid shall be a Neenah R-1741-D, marked "SANITARY SEWER" or approved equal.

PART 3 - EXECUTION

3.1 EARTHWORK

- A. Excavating, trenching, and backfilling are specified in Section 312000 "Earth Moving."

3.2 PIPING INSTALLATION

- A. General Locations and Arrangements: Drawing plans and details indicate general location and arrangement of underground sanitary sewer piping. Location and arrangement of piping layout take into account design considerations. Install piping as indicated, to extent practical. Where specific installation is not indicated, follow piping manufacturer's written instructions.
- B. Install piping beginning at low point, true to grades and alignment indicated with unbroken continuity of invert. Place bell ends of piping facing upstream. Install gaskets, seals, sleeves, and couplings according to manufacturer's written instructions for using lubricants, cements, and other installation requirements.
- C. Install manholes for changes in direction unless fittings are indicated. Use fittings for branch connections unless direct tap into existing sewer is indicated.
- D. Install proper size increasers, reducers, and couplings where different sizes or materials of pipes and fittings are connected. Reducing size of piping in direction of flow is prohibited.
- E. Install gravity-flow, nonpressure, drainage piping according to the following:
 - 1. Install piping pitched down in direction of flow, at minimum slope of 1 percent unless otherwise indicated.
 - 2. Install PVC gravity sewer piping according to ASTM D 2321 and ASTM F 1668.
- F. Clear interior of piping and manholes of dirt and superfluous material as work progresses. Maintain swab or drag in piping, and pull past each joint as it is completed. Place plug in end of incomplete piping at end of day and when work stops.
- G. Location
 - 1. Where the sewer location is not located clearly by dimensions on the Drawings, locate the sewer:
 - a. Not closer than ten (10) feet from a water supply main.
 - b. The bottom of the water pipe should be at least eighteen (18) inches above the top of the sewer pipe.
 - c. Where the gravity flow sewers cross above water lines fully encase the sewer pipe for a distance of ten (10) feet on each side of the crossing; or
 - d. Use acceptable water grade pressure pipe with no joint closer horizontally than three (3) feet from the crossing.
 - e. Where concrete encasement is used, provide not less than four (4) inch thickness including that on pipe joints.

3.3 PIPE JOINT CONSTRUCTION

- A. Join gravity-flow, nonpressure, drainage piping according to the following:
 - 1. Join PVC gravity sewer piping according to ASTM D 2321 and ASTM D 3034 for elastomeric-seal joints or ASTM D 3034 for elastomeric-gasket joints.

3.4 MANHOLE INSTALLATION

- A. General: Install manholes complete with appurtenances and accessories indicated.
- B. Install precast concrete manhole sections with sealants according to ASTM C 891.
- C. Install FRP manholes according to manufacturer's written instructions.
- D. Form continuous concrete channels and benches between inlets and outlet.
- E. Set tops of frames and covers flush with finished surface of manholes that occur in pavements. Set tops 3 inches above finished surface elsewhere unless otherwise indicated.
- F. Install manhole-cover inserts in frame and immediately below cover.

3.5 CONCRETE PLACEMENT

- A. Place cast-in-place concrete according to ACI 318.

3.6 CLEANOUT INSTALLATION

- A. Install cleanouts and riser extensions from sewer pipes to cleanouts at grade. Use cast-iron soil pipe fittings in sewer pipes at branches for cleanouts, and use cast-iron soil pipe for riser extensions to cleanouts. Install piping so cleanouts open in direction of flow in sewer pipe.
 - 1. Use Heavy-Duty, top-loading classification cleanouts.
- B. Set cleanout frames and covers in concrete pavement and roads with tops flush with pavement surface.

3.7 CONNECTIONS

- A. Connect nonpressure, gravity-flow drainage piping to building's sanitary building drains specified in Section 221316 "Sanitary Waste and Vent Piping."
- B. Connect force-main piping to building's sanitary force mains specified in Section 221316 "Sanitary Waste and Vent Piping." Terminate piping where indicated.
- C. Make connections to existing piping and underground manholes.
 - 1. Sewer line connections to existing trunks, laterals or side sewers shall be left uncovered until after and acceptance inspection has been made by the Owner. After approval of

the connection, the bare pipe shall be covered with compacted granular material to a minimum depth of twelve (12) inches above the crown of the pipe. The trench shall then be fully backfilled as required. No existing storm sewer, storm drain, or drain tile shall be connected to a sanitary sewer.

2. Use commercially manufactured wye fittings for piping branch connections. Remove section of existing pipe, install wye fitting into existing piping, and encase entire wye fitting plus 6-inch (150-mm) overlap with not less than 6 inches (150 mm) of concrete with 28-day compressive strength of 3000 psi (20.7 MPa).
3. Special care shall be taken to see that the opening through which pipes enter the structures have all pipe ends sawed when required and smoothed completely. The pipes shall not protrude farther than three (3) inches into the outside face of the manhole, measured along the horizontal center of the pipe.
4. Sealing the pipe to the wall opening shall be through the use of rubber water stops, "O" ring gaskets, pipe boots, or poured-in-place pipe sleeves for water tightness between the pipe and manhole.
5. When new holes are required in the manhole, they shall be core drilled or star drilled in a circle of the required diameter and then knocked out. In no instance shall new holes be sledgehammered out.
6. Protect existing piping and manholes to prevent concrete or debris from entering while making tap connections. Remove debris or other extraneous material that may accumulate.

D. Pipe Connections to New Manholes

1. PVC Pipe Connections to New Manholes shall be with an approved compression gasket.

3.8 IDENTIFICATION

- A. Comply with requirements in Section 31200 "Earth Moving" for underground utility identification devices. Arrange for installation of green warning tapes directly over piping and at outside edges of underground manholes.
1. Use detectable warning tape over ferrous piping.
 2. Use detectable warning tape over nonferrous piping and over edges of underground manholes.

3.9 FIELD QUALITY CONTROL

- A. Inspect interior of piping to determine whether line displacement or other damage has occurred. Inspect after approximately 24 inches of backfill is in place, and again at completion of Project.
1. Submit separate report for each system inspection.

2. Defects requiring correction include the following:
 - a. Alignment: Less than full diameter of inside of pipe is visible between structures.
 - b. Deflection: Flexible piping with deflection that prevents passage of ball or cylinder of size not less than 92.5 percent of piping diameter.
 - c. Damage: Crushed, broken, cracked, or otherwise damaged piping.
 - d. Infiltration: Water leakage into piping.
 - e. Exfiltration: Water leakage from or around piping.
 3. Replace defective piping using new materials, and repeat inspections until defects are within allowances specified.
 4. Reinspect and repeat procedure until results are satisfactory.
- B. Test new piping systems, and parts of existing systems that have been altered, extended, or repaired, for leaks and defects.
1. Do not enclose, cover, or put into service before inspection and approval.
 2. Test completed piping systems according to requirements of authorities having jurisdiction.
 3. Schedule tests and inspections by authorities having jurisdiction with at least 24 hours' advance notice.
 4. Submit separate report for each test.
 5. Infiltration: The allowable infiltration/exfiltration for any portion of section of the sanitary sewer shall not exceed 200 gpm/mile/inch of diameter of the pipe. The test for infiltration shall be performed by the Contractor or their designated representative, and witnessed by the Owner. They will be made for each pipe size and over the entire length of that size pipe, with the standard V-notch weir installation. The test can, at the option of the Owner, be made between manholes until the trouble area or areas have been located and corrected to within the allowable 200 gpd/mile/inch of diameter of the pipe for each section of pipe.
 6. Hydrostatic Tests: Test sanitary sewerage according to requirements of authorities having jurisdiction and the following:
 - a. Fill sewer piping with water. Test with pressure of at least 10-foot (3-m) head of water, and maintain such pressure without leakage for at least 15 minutes.
 - b. Close openings in system and fill with water.
 - c. Purge air and refill with water.
 - d. Disconnect water supply.
 - e. Test and inspect joints for leaks.
 7. Air Tests: The test for exfiltration shall be performed by the Contractor or their designated representative; and witnessed by the Owner. Necessary compressors, plugs, valves, equipment and labor shall be furnished by the Contractor, unless otherwise provided. The sewer line shall be sealed at each end between consecutive manholes. The seal at one end shall have an orifice through which to pass air into the pipe. An air supply shall be connected to the orifice, with appropriate shut-off valve and pressure gauge, reading between 0 and 5 psi. The pipeline shall be pressurized to stabilize pressure of 3.5 to 4 psi

for five minutes. If necessary, air shall be added to the line to maintain the pressure at 3.5 psi. The valve shall then be closed and timing started; when the pressure drops to 2.5 psi, the test is over and the time recorded. The lapsed leakage time is then checked against the formula for allowable leakage time.

- a. Formula for Calculating Allowable Leakage Time. Minimum pressure holding time in seconds equals the pipe diameter in inches multiplied by seventy five (75).
- b. Example: Minimum air holding for 8 inch sewer
 $8 \times 75 = 600$ or 10 minutes

8. Water Tests:

- a. The test for exfiltration shall be performed by the Contractor or their designated representative; and witnessed by the Owner. Necessary water plugs, equipment and labor shall be furnished by Contractor, unless otherwise provided. This test shall be made between the two (2) successive manholes by closing the lower end of the sewer to be tested and the inlet sewer of the manhole with stoppers and filling the pipe and manhole with water to a point four (4) feet above the top of the pipe of the open sewer in the upstream manhole. The Owner shall note the drop in head and calculate the leakage.
- b. If the infiltration/exfiltration in any section of the sewer is greater than the above mentioned figure, the Contractor shall not be paid for that section of sewer until said section is made watertight such that the infiltration is equal to or less than the above mentioned figure.

9. Manholes:

- a. All Sanitary manholes shall be Air-Vacuum tested per ASTM C1244.
- b. Furnish, install and operate all equipment, and materials, including meters, gauges, fuel, bulkheads, water and accessory equipment and all manpower for the test.
- c. If the test fails, the Contractor shall determine the cause, and then repair/replace the manhole to the satisfaction of the Engineer. The test shall be repeated until it is successful.

10. Vertical Deflection Testing: For flexible sewer pipe, the entire length of installed pipe shall be tested for acceptance with an approved go-no-go mandrel under the observation of the Owner. The testing shall be conducted after the final backfill has been in place for at least thirty (30) days. No pipe shall exceed a deflection of five percent (5%). The deflection test shall be run using a mandrel having a diameter equal to ninety five percent (95%) of the inside diameter of the pipe. The test shall be performed without a mechanical pulling device. All pipe exceeding the allowable deflection shall be replaced, repaired and retested.

C. Leaks and loss in test pressure constitute defects that must be repaired.

D. Replace leaking piping using new materials, and repeat testing until leakage is within allowances specified.

3.10 CLEANING

- A. Clean dirt and superfluous material from interior of piping.

END OF SECTION 221313

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SECTION 237433 - DEDICATED OUTDOOR-AIR UNITS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section includes factory-packaged units capable of supplying up to 100 percent outdoor air and providing cooling and heating.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product. Include rated capacities, operating characteristics, and furnished specialties and accessories.
- B. Shop Drawings:
 - 1. Include plans, elevations, sections, and attachment details.
 - 2. Include details of equipment assemblies. Indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
 - 3. Prepare the following by or under the supervision of a qualified professional engineer:
 - a. Mounting Details: For securing and flashing roof curb to roof structure. Indicate coordinating requirements with roof membrane system.
 - b. Include diagrams for power, signal, and control wiring.

1.4 INFORMATIONAL SUBMITTALS

- A. Coordination Drawings: Roof-curb mounting details, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of the items involved:
 - 1. Size and location of unit-mounted rails and anchor points and methods for anchoring units to roof curb.
 - 2. Required roof penetrations for ducts, pipes, and electrical raceways, including size and location of each penetration.
- B. Startup service reports.

- C. Sample Warranty: For special warranty.

1.5 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For units to include in emergency, operation, and maintenance manuals.

1.6 MAINTENANCE MATERIAL SUBMITTALS

- A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
 - 1. Fan Belts: One set[s] for each belt-driven fan.
 - 2. Filters: One set[s] for each unit.

1.7 WARRANTY

- A. Special Warranty: Manufacturer agrees to replace components of units that fail in materials or workmanship within specified warranty period.
 - 1. Warranty Period for Compressors: Five years from date of Substantial Completion.
 - 2. Warranty Period for Heat Exchangers: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. AAON.
 - 2. Addison.
 - 3. Carrier
 - 4. Daikin.
 - 5. Engineered Air.
 - 6. Johnson Controls, Inc.
 - 7. REZNOR, a brand of Nortek Global HVAC.
 - 8. Trane.

2.2 PERFORMANCE REQUIREMENTS

- A. General Fabrication Requirements: Comply with requirements in ASHRAE 62.1, Section 5 - "Systems and Equipment," and Section 7 - "Construction and System Start-up."

B. Cabinet Thermal Performance:

1. Maximum Overall U-Value: Comply with requirements in ASHRAE/IESNA 90.1.
2. Include effects of metal-to-metal contact and thermal bridges in the calculations.

C. Cabinet Surface Condensation:

1. Cabinet shall have additional insulation and vapor seals if required to prevent condensation on the interior and exterior of the cabinet.
2. Portions of cabinet located downstream from the cooling coil shall have a thermal break at each thermal bridge between the exterior and interior casing to prevent condensation from occurring on the interior and exterior surfaces. The thermal break shall not compromise the structural integrity of the cabinet.

D. 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.

E. Capacities and Characteristics: See schedule on drawings.

2.3 CABINET

A. Construction: Double wall.

B. Exterior Casing Material: Galvanized steel with paint finish.

C. Interior Casing Material: Galvanized steel.

D. Lifting and Handling Provisions: Factory-installed shipping skids and lifting lugs.

E. Base Rails: Galvanized-steel rails for mounting on roof curb or pad as indicated.

F. Access for Inspection, Cleaning, and Maintenance: Comply with requirements in ASHRAE 62.1.

1. Service Doors: Hinged access doors with gaskets. Material and construction of doors shall match material and construction of cabinet in which doors are installed.

G. Roof: Standing seam or membrane; sloped to drain water.

H. Floor: Reinforced, metal surface; reinforced to limit deflection when walked on by service personnel. Insulation shall be below metal walking surface.

I. Cabinet Insulation:

1. Type: Fibrous-glass duct lining complying with ASTM C 1071, Type II or flexible elastomeric insulation complying with ASTM C 534, Type II, sheet materials.
2. Rating: R-13.
3. Thickness: 2 inches (50 mm).
4. Insulation Adhesive: Comply with ASTM C 916, Type I.

5. Mechanical Fasteners: Suitable for adhesive, mechanical, or welding attachment to casing without damaging liner and without causing air leakage when applied as recommended by manufacturer.

J. Condensate Drain Pans:

1. Shape: Rectangular, with 1 percent slope in at least two planes to direct water toward drain connection.
2. Size: Large enough to collect condensate from cooling coils including coil piping connections, coil headers, and return bends.
 - a. Depth: A minimum of 2 inches (50 mm) deep.
3. Configuration: Single wall.
4. Material: Stainless-steel sheet.
5. Drain Connection:
 - a. Located on one end of pan, at lowest point of pan.
 - b. Terminated with threaded nipple.
 - c. Minimum Connection Size: NPS 1 (DN 25).
6. Units with stacked coils shall have an intermediate drain pan to collect condensate from top coil.

- K. Surfaces in Contact with Airstream: Comply with requirements in ASHRAE 62.1 for resistance to mold and erosion.

- L. Roof Curb: Full-perimeter curb of sheet metal, minimum 16 inches (400 mm) above the top of the roof insulation, with wood nailer, neoprene sealing strip, and welded Z-bar flashing.

1. Comply with requirements in "The NRCA Roofing Manual."

2.4 SUPPLY FAN

- A. Fan shall be high efficiency, centrifugal fan with backward curved impeller.
- B. Motors:
1. Comply with NEMA designation, temperature rating, service factor, and efficiency requirements for motors specified in Section 230513 "Common Motor Requirements for HVAC Equipment."
- C. Mounting: Fan wheel, motor, and drives shall be mounted to fan casing with spring isolators.

2.5 COOLING COILS

- A. Capacity Ratings: Comply with ASHRAE 33 and ARI 410 and coil bearing the ARI label.
- B. Coil Casing Material: Manufacturer's standard material.

- C. Tube Material: Copper.
- D. Tube Header Material: Manufacturer's standard material.
- E. Fin Material: Aluminum.
- F. Fin and Tube Joints: Mechanical bond.
- G. Leak Test: Coils shall be leak tested with air underwater.
- H. Refrigerant Coil Capacity Reduction: Circuit coils for face control.
- I. Refrigerant Coil Suction and Distributor Header Materials: Seamless copper tube with brazed joints.
- J. Coating: Corrosion-resistant coating after assembly.

2.6 REFRIGERATION SYSTEM

- A. Comply with requirements in ASHRAE 15, "Safety Standard for Refrigeration Systems."
- B. Refrigerant Charge: Factory charged with refrigerant and filled with oil.
- C. Compressors: Scroll compressors with integral vibration isolators, internal overcurrent and overtemperature protection, internal pressure relief, and crankcase heater.
- D. Refrigerant: R-410A.
 - 1. Classified as Safety Group A1 according to ASHRAE 34.
 - 2. Provide unit with operating charge of refrigerant.
- E. Refrigeration System Specialties:
 - 1. Expansion valve with replaceable thermostatic element.
 - 2. Refrigerant dryer.
 - 3. High-pressure switch.
 - 4. Low-pressure switch.
 - 5. Thermostat for coil freeze-up protection during low ambient temperature operation or loss of air.
 - 6. Brass service valves installed in discharge and liquid lines.
- F. Capacity Control:
 - 1. Hot-gas bypass refrigerant control for capacity control with continuous dehumidification on a single compressor.
- G. Refrigerant condenser coils:
 - 1. Capacity Ratings: Complying with ASHRAE 33 and ARI 410 and coil bearing the ARI label.

2. Tube Material: Copper.
3. Fin Material: Aluminum.
4. Fin and Tube Joint: Mechanical bond.
5. Leak Test: Coils shall be leak tested with air underwater.
6. Coating: Corrosion-resistant coating after assembly.

H. Condenser Fan Assembly:

1. Fans: Direct-drive propeller type with statically and dynamically balanced fan blades.
2. Fan Motors:
 - a. Comply with NEMA designation, temperature rating, service factor, and efficiency requirements for motors specified in Section 230513 "Common Motor Requirements for HVAC Equipment."
 - b. Motor Enclosure: Totally enclosed non-ventilating (TENV) or totally enclosed air over (TEAO) enclosure.
 - c. Enclosure Materials: Cast iron.
 - d. Motor Bearings: Permanently lubricated bearings.
3. Fan Safety Guards: Steel with corrosion-resistant coating.

I. Safety Controls:

1. Compressor motor and condenser coil fan motor low ambient lockout.
2. Overcurrent protection for compressor motor.

2.7 INDIRECT-FIRED GAS FURNACE HEATING

A. Furnace Assembly:

1. Factory assembled, piped, and wired.
2. Comply with requirements in NFPA 54, "National Fuel Gas Code," and ANSI Z21.47, "Gas-Fired Central Furnaces."
3. AGA Approval: Designed and certified by and bearing label of AGA.

B. Burners:

1. Heat-Exchanger Material: Aluminized steel with stainless-steel inserts with a minimum thermal efficiency of 80 percent.
2. Fuel: Natural gas.
3. Ignition: Electronically controlled electric spark with flame sensor.

C. Heat-Exchanger Drain Pan Material: Stainless steel.

D. Venting: Power vent with integral, motorized centrifugal fan interlocked with gas valve.

E. Safety Controls:

1. Gas Control Valve: Single stage.
2. Gas Train: Single-body, regulated, redundant, 24-V ac gas valve assembly containing pilot solenoid valve, pilot filter, pressure regulator, pilot shutoff, and manual shutoff.

2.8 OUTDOOR-AIR INTAKE HOOD

- A. Type: Manufacturer's standard hood or louver.
- B. Materials: Match cabinet.
- C. Bird Screen: Comply with requirements in ASHRAE 62.1.
- D. Configuration: Designed to inhibit wind-driven rain and snow from entering unit.

2.9 FILTERS

- A. Disposable Panel Filters:
 1. Comply with NFPA 90A.
 2. Factory-fabricated, viscous-coated, flat-panel type.
 3. Thickness: 2 inches (50 mm).
 4. Minimum Arrestance: 80, according to ASHRAE 52.1.
 5. Minimum MERV: 6, according to ASHRAE 52.2.
 6. Media: Interlaced glass fibers sprayed with nonflammable adhesive and antimicrobial agent.
- B. Mounting Frames:
 1. Panel filters arranged for flat or angular orientation, with access doors on both sides of unit. Filters shall be removable from one side or from access plenum.
 2. Extended surface filters arranged for flat orientation, removable from access plenum.
 3. Galvanized or stainless steel with gaskets and fasteners, suitable for bolting together into built-up filter banks.

2.10 ELECTRICAL POWER CONNECTIONS

- A. General Electrical Power Connection Requirements: Factory-installed and -wired switches, motor controllers, transformers, and other necessary electrical devices shall provide a single-point field power connection to unit.
- B. Enclosure: NEMA 250, Type 3R, mounted in unit with hinged access door in unit cabinet having a lock and key.
- C. Wiring: Numbered and color-coded to match wiring diagram.
- D. Wiring Location: Install factory wiring outside an enclosure in a raceway.

- E. Factory Wiring: Branch power circuit to each motor and to controls with one of the following disconnecting means:
 - 1. NEMA KS 1, heavy-duty, nonfusible switch.
- F. Factory-Mounted, Overcurrent-Protection Service: For each motor.
- G. Transformer: Factory mounted with primary and secondary fuses and sized with enough capacity to operate electrical load plus spare capacity.
- H. Controls: Factory wire unit-mounted controls where indicated.
- I. Lights: Not required.
- J. Receptacle: Factory wire unit-mounted, ground fault interrupt (GFI) duplex receptacle.
- K. Control Relays: Auxiliary and adjustable time-delay relays.

2.11 CONTROLS

- A. Control Wiring: Factory wire connection for controls' power supply.
- B. Control Devices: Sensors, transmitters, relays, switches, detectors, operators, actuators, and valves shall be manufacturer's standard items to accomplish indicated control functions.
- C. Unit-Mounted Status Panel:
 - 1. Cooling/Off/Heating Controls: Control operational mode.
 - 2. Damper Position: Indicate position of outdoor-air dampers in terms of percentage of outdoor air.
 - 3. Status Lights:
 - a. Filter dirty.
 - b. Fan operating.
 - c. Cooling operating.
 - d. Heating operating.
 - e. Smoke alarm.
 - f. General alarm.
 - 4. Digital Numeric Display:
 - a. Outdoor airflow.
 - b. Supply airflow.
 - c. Outdoor dry-bulb temperature.
 - d. Outdoor dew point temperature.
 - e. Space temperature.
 - f. Supply temperature.
 - g. Space relative humidity.
 - h. Space carbon dioxide level.

D. Control Dampers:

1. Damper Location: Factory installed inside unit for ease of blade axle and bushing service. Arrange dampers located in a mixing box to achieve convergent airflow to minimize stratification.
2. Damper Leakage: Comply with requirements in AMCA 500-D. Leakage shall not exceed 6.5 cfm per sq. ft. (33 L/s per sq. m) at a static-pressure differential of 4.0 inches water column (1000 Pa) when a torque of 5 inch pounds per sq. ft. (30.1 Newton meters per sq. m) is applied to the damper jackshaft.
3. Damper Rating: Rated for close-off pressure equal to the fan shutoff pressure.
4. Damper Label: Bear the AMCA seal for both air leakage and performance.
5. Blade Configuration: Unless otherwise indicated, use parallel blade configuration for two-position control and equipment isolation service and use modulating control when mixing two airstreams. For other applications, use an opposed-blade configuration.
6. Damper Frame Material: Extruded aluminum.
7. Blade Type: Single-thickness metal reinforced with multiple V-grooves.
8. Blade Material: Galvanized steel.
9. Maximum Blade Width: 6 inches (150 mm).
10. Maximum Blade Length: 48 inches (1200 mm).
11. Blade Seals: Replaceable, continuous perimeter vinyl seals and jambs with stainless-steel compression-type seals.
12. Bearings: Thrust bearings for vertical blade axles.

E. Damper Operators:

1. Factory-installed electric operator for each damper assembly with one operator for each damper assembly mounted to the damper frame.
2. Operator capable of shutoff against fan pressure and able to operate the damper with sufficient reserve power to achieve smooth modulating action and proper speed of response at the velocity and pressure conditions to which the damper is subjected.
3. Maximum Operating Time: Open or close damper 90 degrees in 60 seconds.
4. Adjustable Stops: For both maximum and minimum positions.
5. Position Indicator and Graduated Scale: Factory installed on each actuator with words "OPEN" and "CLOSED," or similar identification, at travel limits.
6. Spring-return operator to fail-safe; either closed or open as required by application.
7. Operator Type: Direct coupled, designed for minimum 60,000 full-stroke cycles at rated torque.
8. Position feedback Signal: For remote monitoring of damper position.
9. Coupling: V-bolt and V-shaped, toothed cradle.
10. Circuitry: Electronic overload or digital rotation-sensing circuitry.

F. Refrigeration System Controls:

1. Unit-mounted enthalpy controller shall lock out refrigerant system when outdoor-air enthalpy is less than 28 Btu/lb (65 kJ/kg) of dry air or outdoor-air temperature is less than 60 deg F (15 deg C).
2. Relative-humidity sensor energizes dehumidifier operation when relative humidity is more than 50 percent.

- G. Furnace Controls:
 - 1. Wall-mounted, space-temperature sensor with temperature adjustment to modulate gas furnace burner to maintain space temperature.
- H. Damper Controls: Space pressure sensor modulates outdoor- and return-air dampers to maintain a positive pressure in space at a minimum of 0.05 inch wg (12.4 Pa) with respect to outdoor reference.
- I. Integral Smoke Alarm: Smoke detector installed in return air.
- J. Interface with DDC System for HVAC: Factory-installed hardware and software to enable the DDC system for HVAC to monitor, control, and display unit status and alarms.
 - 1. Hardwired Points:
 - a. Monitoring: On-off status, common trouble alarm.
 - b. Control: On-off operation, space temperature set-point adjustment.
 - 2. ASHRAE 135 (BACnet) communication interface with the DDC system for HVAC shall enable the DDC system for HVAC operator to remotely control and monitor the unit from an operator workstation. Control features and monitoring points displayed locally at unit control panel shall be available through the DDC system for HVAC.

2.12 ACCESSORIES

- A. Duplex Receptacle: Factory mounted in unit supply-fan section [and refrigeration section], with 20 amp 120 V GFI duplex receptacle and weatherproof cover.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
- B. Examine roughing-in for piping, ducts, and electrical systems to verify actual locations of connections before equipment installation.
- C. Examine roof curbs and equipment supports for suitable conditions where units will be installed.
- D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Comply with manufacturer's rigging and installation instructions for unloading units and moving to final locations.
- B. Curb Support: Install roof curb on roof structure according to "The NRCA Roofing Manual."
 - 1. Install and secure units on curbs and coordinate roof penetrations and flashing with roof construction.
 - 2. Coordinate size, installation, and structural capacity of roof curbs, equipment supports, and roof penetrations. These items are specified in Section 077200 "Roof Accessories."
 - 3. Coordinate size, location, and installation of unit manufacturer's roof curbs and equipment supports with roof Installer.
- C. Equipment Mounting:
 - 1. Comply with requirements for vibration isolation devices specified in Section 230548.13 "Vibration Controls for HVAC."
- D. Install wall- and duct-mounted sensors furnished by manufacturer for field installation. Install control wiring and make final connections to control devices and unit control panel.
- E. Comply with requirements for gas-fired furnace installation in NFPA 54, "National Fuel Gas Code."
- F. Install separate devices furnished by manufacturer and not factory installed.
- G. Install new filters at completion of equipment installation and before testing, adjusting, and balancing.
- H. Install drain pipes from unit drain pans to sanitary drain.
 - 1. Drain Piping: Drawn-temper copper water tubing complying with ASTM B 88, Type L (ASTM B 88M, Type B), with soldered joints.
 - 2. Drain Piping: Schedule 40 PVC pipe complying with ASTM D 1785, with solvent-welded fittings.
 - 3. Pipe Size: Same size as condensate drain pan connection.

3.3 CONNECTIONS

- A. Where installing piping adjacent to units, allow space for service and maintenance.
- B. Gas Piping Connections:
 - 1. Comply with requirements in Division 22 "Facility Natural-Gas Piping."
 - 2. Connect gas piping to furnace, full size of gas train inlet, and connect with union, pressure regulator, and shutoff valve with sufficient clearance for burner removal and service.
 - 3. Install AGA-approved flexible connectors.

C. Duct Connections:

1. Comply with requirements in Section 233113 "Metal Ducts."
2. Drawings indicate the general arrangement of ducts.
3. Connect ducts to units with flexible duct connectors. Comply with requirements for flexible duct connectors in Section 233300 "Air Duct Accessories."

D. Electrical Connections: Comply with requirements for power wiring, switches, and motor controls in electrical Sections.

1. Install electrical devices furnished by unit manufacturer but not factory mounted.

3.4 STARTUP SERVICE

A. Engage a factory-authorized service representative to perform startup service.

1. Complete installation and startup checks according to manufacturer's written instructions.
2. Inspect units for visible damage to furnace combustion chamber.
3. Perform the following operations for both minimum and maximum firing and adjust burner for peak efficiency:
 - a. Measure gas pressure at manifold.
 - b. Measure combustion-air temperature at inlet to combustion chamber.
 - c. Measure flue-gas temperature at furnace discharge.
 - d. Perform flue-gas analysis. Measure and record flue-gas carbon dioxide and oxygen concentration.
 - e. Measure supply-air temperature and volume when burner is at maximum firing rate and when burner is off. Calculate useful heat to supply air.
4. Verify operation of remote panel including pilot-light operation and failure modes. Inspect the following:
 - a. High-limit heat exchanger.
 - b. Alarms.
5. Inspect units for visible damage to refrigerant compressor, condenser and evaporator coils, and fans.
6. Start refrigeration system when outdoor-air temperature is within normal operating limits and measure and record the following:
 - a. Cooling coil leaving-air, dry- and wet-bulb temperatures.
 - b. Cooling coil entering-air, dry- and wet-bulb temperatures.
 - c. Condenser coil entering-air dry-bulb temperature.
 - d. Condenser coil leaving-air dry-bulb temperature.
7. Simulate maximum cooling demand and inspect the following:

- a. Compressor refrigerant suction and hot-gas pressures.
 - b. Short-circuiting of air through outside coil or from outside coil to outdoor-air intake.
 8. Inspect casing insulation for integrity, moisture content, and adhesion.
 9. Verify that clearances have been provided for servicing.
 10. Verify that controls are connected and operable.
 11. Verify that filters are installed.
 12. Clean coils and inspect for construction debris.
 13. Clean furnace flue and inspect for construction debris.
 14. Inspect operation of power vents.
 15. Purge gas line.
 16. Inspect and adjust vibration isolators and seismic restraints.
 17. Verify bearing lubrication.
 18. Clean fans and inspect fan-wheel rotation for movement in correct direction without vibration and binding.
 19. Adjust fan belts to proper alignment and tension.
 20. Start unit.
 21. Inspect and record performance of interlocks and protective devices including response to smoke detectors by fan controls and fire alarm.
 22. Operate unit for run-in period.
 23. Calibrate controls.
 24. Adjust and inspect high-temperature limits.
 25. Inspect outdoor-air dampers for proper stroke and interlock with return-air dampers.
 26. Verify operational sequence of controls.
 27. Measure and record the following airflows. Plot fan volumes on fan curve.
 - a. Supply-air volume.
 - b. Return-air flow.
 - c. Outdoor-air flow.
 - B. After startup, change filters, verify bearing lubrication, and adjust belt tension.
 - C. Remove and replace components that do not properly operate and repeat startup procedures as specified above.
 - D. Prepare written report of the results of startup services.
- 3.5 ADJUSTING
- A. Adjust initial temperature and humidity set points.
 - B. Set field-adjustable switches and circuit-breaker trip ranges as indicated.
 - C. Occupancy Adjustments: When requested within 12 months from date of Substantial Completion, provide on-site assistance in adjusting system to suit actual occupied conditions. Provide up to two visits to Project during other-than-normal occupancy hours for this purpose.

3.6 DEMONSTRATION

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain units.

END OF SECTION 237433

SECTION 262313
PARALLELING & DISTRIBUTION SWITCHBOARD

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Generator Paralleling Sections.
- B. Distribution Switchboard.

1.2 RELATED SECTIONS AND WORK

- A. Refer to the One-Line Diagram for size, rating, and configuration.
- B. Section 26 24 13 - Switchboards
- C. Section 26 36 00 - Transfer Switches
- D. Section 26 32 13 - Packaged Engine Generator System

1.3 QUALITY CONTROL AND SYSTEM COORDINATION

- A. The generator manufacturer shall supply the paralleling distribution equipment to provide a single source of responsibility for the entire system. Thus, the generator manufacturer shall provide a fully operational and tested turnkey system. The system shall include the generators, parallel distribution equipment, automatic transfer switches, and related control equipment.
- B. Provide factory trained technicians to oversee the final installation, programming, testing, witness testing, and commissioning of the complete system. The complete system shall include the paralleling distribution equipment, generators, and automatic transfer switches.
- C. Functional (Witness) Testing: Provide functional testing per this specification section.
- D. Commissioning: Provide factory trained technicians for commissioning the installed system. The system commissioning shall include at least one full day to test the system. Additional commissioning days may be required if the system fails to pass the commissioning test. A commissioning report that defines the criteria for a satisfactory test will be provided by the Architect/Engineer prior to the commissioning date. The date of the commissioning testing shall be coordinated between the Owner, Architect/Engineer, and manufacturer.

1.4 REFERENCES

- A. FS W-C-375 - Circuit Breakers, Molded Case, Branch Circuit and Service
- B. NEMA AB 1 - Molded Case Circuit Breakers
- C. NEMA PB 2 - Dead Front Distribution Switchboards
- D. NEMA PB 2.1 - Instructions for Safe Handling, Installation, Operation and Maintenance of Dead Front Switchboards Rated 600 volts or less
- E. ANSI/IEC C12 - Code for Electricity Metering
- F. ANSI/IEC C39.1 - Requirements for Electrical Analog Indicating Instruments
- G. ANSI/IEC C57.13 - Requirements for Instrument Transformers
- H. ANSI/IEC 1000.4.4 - Fast Transients Immunity
- I. ANSI/IEC 1000.4.2 - Electrostatic Discharge Immunity
- J. ANSI/IEC 1000.4.3 - Radiated Field Immunity
- K. ANSI/IEC 1000.4.6 - Conducted Field Immunity
- L. ANSI/IEC 1000.4.11 - Voltage Dip Immunity

- M. NFPA 70 - National Electrical Code; latest 2008 edition
- N. NFPA 99 – Standard for Health Care Facilities
- O. NFPA 110 - Emergency and Standby Power Systems
- P. IEEE 446 - Recommended Practice for Emergency and Standby Power Systems for Commercial and Industrial Applications
- Q. UL891 - Switchboards and Controls Equipment
- R. UL489 - Low Voltage Circuit Breakers
- S. ANSI/IEC C37.20.1 - Metal Enclosed Low Voltage Power Circuit Breaker Switchgear
- T. ANSI/IEC C37.51 - Testing of Metal-Enclosed Low Voltage AC Power Circuit Breaker Switchgear
- U. NEMA SG-5 - Power Switchgear Assemblies
- V. UL 1558 - Switchgear Assemblies
- W. UL1066 - Power Circuit Breakers

1.5 SUBMITTALS

- A. Submit product data under provisions of Division 1.
- B. Include front and side views of enclosures with overall dimensions shown; conduit entrance locations and requirements; nameplate legends; size and number of bus bars per phase, neutral, and ground; switchboard instrument details; instructions for handling and installation of switchboard; and electrical characteristics including voltage, frame size and trip ratings, withstand ratings, and time-current curves of all equipment and components; diagram; completed nameplate schedule.
- C. Submit AC One-Line or Three-line schematic diagram with individual components referenced or identified.
- D. Submit DC schematic diagrams with all components referenced or identified.
- E. Include equipment access information. Clearly indicate which locations require access during installation and which locations require access for maintenance, testing, and repair.
- F. Certification Letter: The manufacturer shall provide a letter certifying compliance with all the requirements of this specification. Any exceptions to the specification shall be listed.
- G. Submit complete control and operation sequence which outlines system operation.
- H. Submit manufacturer's installation instructions under provisions of Section 26 05 00.
- I. Include documentation of conformance with the qualifications section of this section.

1.6 SPARE PARTS

- A. Keys: Furnish four (4) each to the Owner.
- B. Control Fuses: Furnish three (3) spare fuses of each type and rating installed to the Owner.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Deliver products to site under provisions of Section 26 05 00.
- B. Store and protect products under provisions of Section 26 05 00.
- C. Deliver in 48" maximum width shipping splits, unless approved otherwise by both the Contractor and Architect/Engineer, individually wrapped for protection, and mounted on shipping skids.

- D. Store in a clean, dry space. Maintain factory wrapping or provide an additional waterproof cover to protect units from dirt, water, and debris.
- E. Handle in accordance with NEMA PB 2.1 and manufacturer's written instructions. Lift only with lifting lugs. Handle carefully to avoid damage.

1.8 OPERATION AND MAINTENANCE DATA

- A. Submit operation and maintenance data under provisions of Section 26 05 00.
- B. Include instructions for operating equipment based on the control sequences.
- C. Include instructions for operating equipment under emergency conditions when engine generator is running.
- D. Include spare parts data listing; source and current prices of replacement parts and supplies; and recommended maintenance procedures and intervals.
- E. List special tools, maintenance materials, and replacement parts.

1.9 QUALIFICATIONS

- A. Manufacturer: Company specializing in paralleling equipment with minimum five (5) years documented experience.
- B. Supplier: Authorized distributor of paralleling equipment with service facilities within 50 miles of the project site.

1.10 WARRANTY AND SERVICE

- A. The manufacturer shall warrant the equipment to be free from defects in material and workmanship for 24 months from the date of shipment.
- B. Manufacturer shall have an established network of service centers capable of servicing the specified equipment.
- C. Service center and manufacturer's personnel shall be on call 24 hours a day, 365 days a year. Personnel shall be factory trained and certified in the maintenance and repair of the specified equipment.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS - PARALLELING AND DISTRIBUTION SWITCHBOARD

- A. ASCO
- B. Russlectric

2.2 RATINGS

- A. Definitions:
 - 1. The paralleling and distribution switchboards for this project shall be fully rated unless otherwise specifically noted in the Drawings or Specifications.

2.3 PARALLELING AND DISTRIBUTION CIRCUIT BREAKER SWITCHBOARD

- A. The freestanding paralleling and distribution switchboard shall be configured as shown on the contract drawings, and rated for operation at voltage and current levels as shown on drawings. It shall contain devices and equipment as shown on the drawings, in addition to the requirements of this section.
- B. Low-Voltage Insulated Case Circuit Breaker Switchgear: NEMA PB2; UL-1558 metal-enclosed switchboard assembly including compartmentalized draw-out circuit breakers in free-standing cubicles, securely bolted together to form an integrated structure.
- C. Provide silver plated copper bus with bolted joints for all phases, fully rated neutral, and ground bus that extends through each section. All vertical and horizontal distribution bussing shall be fully rated.
- D. Meet requirements for service conditions as follows:
 - 1. Maximum Ambient Temperature: 120°F.
 - 2. Altitude: 1000 feet.
- E. Meet requirements for use as service disconnecting means.
- F. Nominal Voltage: 480-volt, 3 phase, 4 wire, 60 Hertz.
- G. Short-Circuit Rating: 100 as indicated on plan KA rms, at rated maximum voltage.
- H. Voltage and Insulation Levels: To ANSI/IEEE C37.20.
- I. Momentary Current Rating: To ANSI/IEEE C37.20.
- J. Install fuses in safety fuse blocks with visible fuse blown indicators.
- K. Install fuses in safety fuse blocks with visible fuse blown indicators.
- L. Provide insulated barriers between all circuit breakers and the bus structure.
- M. Provide insulated barriers between the busing and cable compartments.
- N. Provide insulated compartments and barriers for instrumentation and control equipment. Circuit breakers shall be installed in separate compartments with insulating barriers between the control equipment compartments and the circuit breaker compartments.
- O. Each section shall contain one or more individual circuit breaker compartments or instrumentation compartments with a rear compartment for the buses and outgoing cable terminations. An insulated barrier instrumentation compartment shall be provided when additional instruments or controls are provided in the switchboard section of a circuit breaker compartment. Provide dedicated conduit entry for control cabling separate from power cabling entry locations.
- P. Locks: Front doors shall be supplied with a lockable handle. All door locks shall be keyed alike to operate from a single key and one key shall be supplied for each lock. Full height doors shall latch at three (3) points to secure the door firmly.
- Q. Provide adequate wire bending space for circuit breakers. Refer to the plans for wire size; allow for 750 KCM minimum.

- R. Sheet Metal Finish: Prime painted with a rust-inhibiting primer and finished with two coats of satin finish ANSI 61 gray enamel.
- S. Switchgear wiring shall be composed of UL listed, 105 degree C rated material, with all wiring labeled at each end and terminal block.
- T. Use solderless compression type connectors for terminating all wires to devices requiring lugs. Devices designed for lug-less connections will not use lugs at those connection points. Other circuits shall be locking spade type applied with the proper tool.
- U. All interconnections between shipping sections shall use locking pull-apart terminal blocks.

2.4 ACCEPTABLE MANUFACTURER - POWER CIRCUIT BREAKERS

- A. Square D
- B. Siemens

2.5 LOW VOLTAGE INSULATED-CASE CIRCUIT BREAKERS

- A. Circuit Breaker: Insulated case with programmable trip functions; NEMA A81 and UL-1066.
- B. Circuit Breaker Operator: Spring-charged stored energy. With electric operator to ANSI/IEEE C37.17 and electric trip with auxiliary contacts. Provide for manual charging of the mechanism and interlocks to prevent withdraw of the circuit breaker unless it is open. Circuit breaker shall be 120 volt AC for charging and closing purposes with 24VDC shunt trip system. When required provide an individual control power transformer for each generator paralleling and generator main tie circuit breaker from the main tie main bus, generator paralleling bus, generator side of the circuit breaker, utility side of the circuit breaker.
- C. Rated Maximum Voltage: 600 volt.
- D. Fully rated regardless of mounting location within the switchgear. Rated for 5,000 operation without maintenance for 4,000 amp or larger; rated for 10,000 operations without maintenance for a 4,000 amp or less rating.
- E. Rated Frequency: 60 Hertz.
- F. Rated Permissible Tripping Delay: 2 seconds.
- G. Main Section Devices: Individually mounted and compartmented.
- H. Distribution Section Devices: Individually mounted
- I. Operation Endurance Capability: ANSI/IEEE C37.16.
- J. Circuit Breaker Control Voltage: 120VAC for Charging and Closing operation and 24-volt DC for Tripping operation.
- K. Solid-State Insulated Case Circuit Breakers: Provide insulated case breaker with two-step stored energy closing. Provide manual charging handle, and electric charging motor where indicated as electrically operated. Provide with rating plug as required on drawings and electronic circuits for true rms current sensing, timing, and tripping for fully adjustable time current characteristics including; instantaneous trip; long time trip; short time trip and ground fault indication only. Trip settings shall be field programmable with a sealable clear cover. Provide draw-out construction. Provide breaker interrupted ratings as indicated on the plans.

- L. Provide power trip units with all power metering including amperage, voltage, kW, pF, as well as breaker communications via TCP/IP all wired to a common monitoring point.
- M. Provide Modbus communications TCP/IP for all breakers.
- N. Arc Energy Reduction:
 - 1. Provide an arc energy reduction system to reduce the clearing time of an arc flash event. The arc energy reduction system shall be provided for overcurrent protection devices rated **4000** amps or larger.
- O. Arc Energy Reduction with Selective Coordination:
 - 1. Provide an arc energy reduction system to reduce the clearing time of an arc flash event. The arc energy reduction system shall be provided for overcurrent protection devices rated 4000 amps or larger.
 - 2. The following arc energy reduction system options are acceptable:
 - a. Zone-selective interlocking with permanent arc energy reduction
 - b. Differential relaying with permanent arc energy reduction
 - c. Listed energy-reducing active arch flash mitigating system
- P. All circuit breakers shall be UL 1066 rated for compliance with ANSI/IEC C37.20.
- Q. Provide circuit breakers with padlock hasp.

2.6 MASTER CONTROLLER

- A. Provide a system master control to monitor and control the operation of the entire paralleling system, including the generator set controls. The master control panel shall contain the components and functions described in this section.
 - 1. Electronic isochronous kW load sharing control to operate the engine governors during synchronizing and to provide isochronous load sharing when paralleled. The control system shall allow sharing of real kW load between all generator sets in the system to within 1% of equal levels, without introduction of frequency droop into the system. The control system shall include all equipment required for kW load sharing with an infinite bus. The infinite bus governing controls shall allow the generator set to synchronize to an infinite bus, parallel, and ramp up to a preset load level on the generator set. Additional controls shall be provided to cause the generator set to ramp up to a kW load level signaled by the system master control PLC. The isochronous load sharing module and engine governor shall be a coordinated system of a single manufacturer.
 - 2. Electronic kVAR load sharing control to operate the alternator excitation system while the generator set is paralleled. The control system shall allow sharing of reactive load between all generator sets in the system to within 1% of equal levels, without introduction of voltage droop into the system. The control system shall include all equipment required for VAR load sharing with an infinite bus in either a constant VAR or constant power factor mode for future application flexibility. Mode and adjustments selectable by the operator.
 - 3. Load demand governing controls shall be provided to cause the generator set to ramp down to zero load when signaled to shut down in a load demand mode. On a signal to re-start, the load demand governing controls shall cause the generator

set to synchronize to the system bus, close, and ramp up to its proportional share of the total bus load. The ramp rate of the generator set shall be operator-adjustable.

4. Equipment shall be provided to monitor the generator set as it is starting, and verify that it has reached at least 90% of nominal voltage and frequency before closing to the bus. The equipment provided shall positively prevent out-of-phase paralleling if two or more engine generator sets reach operating conditions simultaneously by providing a lockout signal to disable breaker closure for generator set(s) in the system which have not been selected to be the first units to close to the bus. Controls to recognize the failure of the first breaker signaled to close, and allow system operation to proceed despite this failure shall also be provided (breaker failure alarm). Systems using dead bus relay schemes without a disable signal to positively prevent out-of-phase paralleling shall not be acceptable under this specification. System shall include an independent backup to automatically operate if the primary system fails.
5. Synchronizer to electronically adjust the engine governor to match the voltage, frequency and phase angle of the bus. Synchronizer shall maintain the engine-generator voltage within 1% of bus voltage and phase angle within 20 electrical degrees of the bus for 0.5 seconds before circuit breaker closing. Each unit shall have its own synchronizer; systems using a switching scheme to use a single system synchronizer will not be approved. Synchronizers and systems which utilize a motor driven pot for control of AC voltage during the synchronizing process will not be accepted. The system shall be provided with a fail to synchronize time delay that is adjustable from 10-120 seconds. Control logic for fail to synchronize function shall allow field adjustment of function for either alarm or shutdown of the generator set on failure condition. Synchronizer shall be a product of the generator set governor manufacturer for guaranteed compatibility and performance.
6. Controls shall include a permissive relay function to assure that the generator set does not attempt to close out of phase with the bus, due to errant operation of the synchronizer.
7. Controls shall include a permissive (sync check) function, to be used with "generator synchronized" indicator during manual paralleling, to prevent accidental closure of the breaker with the generator set out of phase with the bus. Provisions to allow manual closure of the first generator set to a de-energized bus shall be included.
8. Control equipment shall contain a system of diagnostic LED's to assist in analyzing proper system function.
9. Controls shall include three phase sensing reverse power equipment, to prevent sustained reverse power flow into the generator set. When the reverse power condition exceeds 10% of the generator set kW for 3 seconds, the paralleling circuit breaker shall be tripped open and the generator shut down.
10. Controls shall be provided to verify generator set and bus phase rotation match prior to closing the paralleling breaker.
11. Microprocessor-based alternator overcurrent alarm and shutdown protection. This protection is required in addition to the overcurrent trip on the paralleling breaker, and shall sense current flow at the generator set output terminals. The overcurrent alarm shall be indicated when the load current on the generator set is more than

- 110% of rated current for more than 60 seconds. The overcurrent shutdown shall be matched to the thermal damage curve of the generator set, and shall not have an instantaneous function.
12. Microprocessor-based alternator short circuit protection. This protection is in addition to the overcurrent trip on the paralleling breaker. The short circuit shall occur when the load current on the generator set is more than 175% of rated current and an aggregate time/current calculation indicates that the system is approaching the thermal damage point of the alternator. The equipment used shall not have an instantaneous function.
 13. Provide overcurrent and short circuit protection for the feeder connecting the generator set to the paralleling switchgear. This protection may be integrated with alternator protection but must be positively coordinated to prevent tripping of the paralleling breaker prior to the operation of the alternator protective equipment.
 14. Controls shall be provided to sense loss of excitation of the alternator while paralleled to the system bus.
 15. Generator set start contacts rated 10 amps at 32 VDC. A redundant network-based starting system shall also be provided.
 16. The control system shall monitor the paralleling breaker auxiliary contacts, and initiate a fault signal if the breaker fails to close within an adjustable time delay period after the control has signaled it to close (0.5-15 seconds). Breaker failure alarm shall cause the paralleling breaker to trip open, and lock out until manually reset.
 17. Controls shall be provided to initiate an alarm condition when generator set is at 90% of rated frequency for more than 10 seconds.
 18. Controls shall be provided to shut down generator set and initiate alarm when the generator set is at less than 85% of nominal voltage for more than 10 seconds, more than 110% of nominal voltage for more than 10 seconds, or more than 130% of nominal.
- B. Provide a hot swappable redundant master controller. The redundant controller will automatically take over all functions if the primary controller fails. The hot swappable capability will allow a maintenance technician to replace a defective control without de-energizing any primary control functions.
- C. Provide Modbus-TCP/IP network card for interface with third party equipment.
- D. Provide a complete NFPA compliance Joint Commission / HVAP reporting server platform which monitors and provides NFPA compliant Emergency System test reports. Other features shall include:
1. Real-time equipment metering, monitoring, and remote access.
 2. Information sharing with power and building management via Modbus.
 3. Notifications and reports about power events and alarms via email, text, and SNMP.
 4. A single intuitive interface for controlling engine-generators, transfer switches, load banks (if applicable)
 5. Monitoring and historical data from all transfer switches fed by the emergency system.
 6. One line diagram representing the entire emergency power system.

7. Reference electronic library storing all manual for generators, transfer switches, and circuit breakers associated with emergency power system.
8. Optional Dynamic/Active line diagram with power event playback functions.

2.7 PROTECTIVE RELAYS, SYNCHRONIZING RELAYS, INSTRUMENTS, AND CONTROLLERS

A. Repetitive Accuracies:

1. Repetitive accuracies for solid state protective relays, devices, controls and monitors shall not exceed stated values for AC powered devices over a voltage range of 70-110% of nominal, and for DC powered devices, over a voltage range of 20 to 40-volt DC.
 - a. Voltage: $\pm 2\%$ of setpoint over a frequency range of 40-70 Hz.
 - b. Current: $\pm 3\%$ of setpoint over a frequency range of 40-70 Hz.
 - c. Frequency: ± 0.2 Hz.
 - d. Power: $\pm 3\%$ of setpoint over a frequency range of 40-70 Hz., across a power factor range of 0.2 to unity, leading or lagging.
 - e. Voltage Difference: ± 1.0 volt over a frequency range of 40-70 Hz.
 - f. Frequency Difference: ± 0.05 Hz.
 - g. Relative Phase Angle: $\pm 1.0^\circ$ at 50 60 Hz.
2. Environmental Conditions: Solid state circuitry, controls, relays, timers, monitors etc. shall meet the following environmental conditions:
 - a. Temperature range: 0°C to $+65^\circ\text{C}$.

B. Protective Relays: Provide industrial grade relaying instruments for each circuit breaker and system level controls. Protective relay package (Generator Protection Package) shall be industrial grade multiple integrated circuit protective relays combined into a single protection package device. Package shall include the following protective relay functions.

1. Directional Power Relay: Provide directional power protection to open the circuit breaker in the event of a power reversal in the generator supply circuit.
2. Voltage/Frequency Stabilization Relay: Provide voltage/frequency stabilization protection to prevent synchronizing operation of the circuit breaker unless voltage and frequency of the generator are within settable limits for a selected period of time.
3. Overcurrent Ground Relay: Provide overcurrent ground protection to provide audible and visual display by means of a local and remote annunciator in the event of a ground fault.
4. Locking-Out Relay: Provide locking-out relays to prevent circuit breaker closing in the event of other protection device operations.
5. Synchronizing Relay: Provide synchronizing relays to allow the closing of the circuit breaker upon either manual or logic commands. Provide with dead bus option.
6. Synchronizing Control: Provide engine governor control to control engine speed for a paralleling sequence and for load pick-up. Control furnished to match the engine-generator supplier's requirements. Synchronizing controller to provide breaker close signal output.

7. Bus Underfrequency Relay: Provide under frequency relay for input to control PLC to indicate system overload.
8. Synchroscope: ANSI C39.1; rotary synchroscope with 4.5-inch square recessed case and divided scale indicating SLOW/FAST, white dial with black figures and pointer, 2-degree accuracy.
9. Synchronizing Light: One LED lighted pushbutton, light turns off when generator is synchronized.
10. Frequency Meter: 4.5-inch square recessed case, pointer type, frequency span - 55/65 Hertz.
11. Current Transformers: ANSI C57.13; Five ampere secondary, bar or window type, with single secondary winding and secondary shorting device, primary/secondary ratio as required, burden and accuracy consistent with connected metering and relay devices, 60 Hertz.
12. Potential Transformers: ANSI C57.13; 120-volt single secondary, disconnecting type with integral primary and secondary fuses, primary/secondary ratio as required, burden and accuracy consistent with connected metering and relay devices, 60 Hertz.
13. AC control circuit shall be protected with line and load side fused which are installed in safety type fuse blocks. Provide visible blown indication for each fuse.
14. Synchronizing Selector Switch: Rotary multi-stage snap-action type with 600-volt AC/DC silver plated contacts, engraved escutcheon plate, oval type handle, and three positions including OFF-MANUAL-AUTOMATIC.
15. Governor Speed Setting, Momentary contact type with 600-volt AC/DC silver plated contacts, engraved escutcheon plate, three position RAISE-OFF-LOWER control.
16. Engine Mode Control Switch: Rotary, oval handle, maintained contact type with 600-volt AC/DC silver plated contacts, engraved escutcheon plate, five- position engine control.
17. System PLC: Programmable logic controller with interface keypad and LCD screen, complete with com port for software changes. Provide programming for all necessary inputs and outputs for system operation.

C. Digital Power Metering:

1. Provide a multifunction digital meter at each generator circuit breaker and control section for generator metering. Each meter shall include a communication module to permit information to be sent to a central monitoring computer for display, analysis, and logging.
2. System programming and setup shall be stored in non-volatile memory and retained in the event of a power interruption.
3. Digital meters shall be equipped with the following I/O: eight (8) solid state status inputs, four (4) relay output contacts.

4. Include LCD back-light display, installed semi-flush in the front of the paralleling distribution equipment. Values shall be displayed through the use of menu scroll buttons. The following metered readings shall be displayed and communicated.
 - a. Current, per phase RMS and neutral.
 - b. Current unbalance %.
 - c. Voltage, phase to phase and phase to neutral.
 - d. Voltage unbalance %.
 - e. Real power (KW), per phase and 3-phase total.
 - f. Apparent power (KVA), per phase and 3-phase total.
 - g. Reactive power (KVAR), per phase and 3-phase total.
 - h. Power factor, 3-phase total & per phase.
 - i. Frequency.
 - j. Accumulated energy (MWH, MVAH and MVARH) – Reset of accumulated energy parameters shall be allowed from the front of the Data Monitor.
 - k. 24 months of peak Demand kW historical data shall be stored within Power Meter non-volatile memory

2.8 SYSTEM CONTROL POWER

- A. Control power for the paralleling and distribution equipment shall be derived from the generator starting batteries; 24 Volt DC.
- B. The control logic shall be powered through a suitable means which shall permit continuity of power until the last battery is no longer available. The controls shall be powered from any battery or combination of batteries and prevent feedback to a failing battery. The transition of control logic power from any battery combination to any other battery combination shall be accomplished without disruption in the power flow.
- C. Provide a solid state, no break “best battery” selector system. The system shall automatically select the alternative battery string for control voltage if the primary battery string has failed. The battery banks of each individual generator shall be isolated to prevent the failure of any one battery from disabling the entire system.
- D. DC Control Power Station Battery System: In addition to the engine start batteries that are used as a source of control power, a separate 24VDC station battery system shall be provided and wired into the Master Control section (wiring by contractor). The station battery system shall include front access batteries, battery charger powered from an emergency 120VAC-240VAC power source, and an integrated DC distribution system capable of accommodating up to twelve (2) pole circuit breakers. The complete DC Control Power Station Battery System shall be housed in a single free standing enclosure, and shall be factory assembled, wired, and tested via 24hr burn in at full load. Voltage readings shall be taken and documented during burn in testing. 24VDC output from the station battery system shall be connected into the Best Battery selector system (wiring by contractor) described below such that 24VDC control power will be available to the critical

system control components, even while the diesel engine-generators are starting up.

2.9 INDICATION

- A. Operating and safety indications, protective devices, basic system controls, engine gauges, and transfer switch statuses shall be grouped in a common control and monitoring panel mounted on front face of the paralleling distribution equipment. The indications components shall be displayed from the master control system display.
- B. Provide a lamp test push button. The test button shall cause all indication lamps on the paralleling and switchboard equipment to be simultaneously tested.
- C. Provide a master audible alarm. The alarm horn shall be the DC vibration type. Provide with an alarm horn silence button.
- D. Provide indication in compliance of ANSI/NFPA 99 and NFPA 110 for a Level 1 2 system. Include the listed pre-alarm and alarm points, audible alarm, alarm silencing means, repetitive alarm circuitry, and lamp test switch in main control section of the paralleling distribution equipment. Provide all interconnecting wiring in conduit per manufacturer's requirements by the Electrical Contractor. The remotely reported alarms shall include the following generator and paralleling equipment indications.

<u>FUNCTION</u>	<u>LAMP COLOR</u>	<u>ALARM HORN</u>
1. Overcrank	Red	Yes
2. Low water (engine) temperature	Red	Yes
3. High engine temperature pre-alarm	Amber	
4. High engine temperature	Red	Yes
5. Low lube oil pressure pre-alarm	Amber	
6. Low lube oil pressure	Red	Yes
7. Overspeed	Red	Yes
8. Under frequency	Red	Yes
9. Under voltage	Red	Yes
10. Over voltage	Red	Yes
11. High battery voltage	Amber	Yes
12. Low battery voltage	Amber	Yes
13. Battery charger failure (includes AC failure)	Amber	Yes
14. Loss of excitation	Red	Yes
15. Low fuel main tank	Amber	Yes
16. Low fuel daytank	Amber	Yes
17. Rupture basin alarm	Red	Yes
18. Reverse Power	Red	Yes
19. Phase rotation	Red	Yes
20. Failure to sync generators	Amber	Yes
21. Ground fault	Amber	Yes
22. Over current alarm	Red	Yes
23. Generator breaker failure	Red	Yes
24. Generator breaker trip	Red	Yes
25. Breaker open (generator)	Green	
26. Breaker closed (generator)	Red	
27. Timer for generator start and transfer	Green	
28. Timer for generator shutdown.	Green	
29. Generator running	Green	
30. Normal utility power	Green	
31. Emergency Power Supply (EPS) supplying load	Green	

<u>FUNCTION</u>	<u>LAMP COLOR</u>	<u>ALARM HORN</u>
32. Not in auto	Red	Yes
33. Emergency stop	Red	Yes
34. Emergency Power Off Switch activated (EPO)	Red	Yes
35. Manual Paralleling available	Green	
36. Load Shed Circuit Activated (one for each priority)	Amber	Yes
37. Load Shed Bypass (one for each priority)	Amber	
38. Generator Locked out (one for each generator)	Red	Yes
39. System PLC Stopped	Red	Yes
40. PLC Power Source Failure	Red	Yes
41. Emergency Bus Optimization Active	Amber	
42. Load Demand Active	Amber	
43. Bus loaded to Capacity	Red	Yes
44. Bus Optimization Stopped Adding	Red	Yes
45. Indicator lamps: High intensity LED type or liquid crystal display LCD type.		
46. Door mounted control components shall be industrial oil-tight type devices.		
47. Alarm Horn: Provide an alarm horn silence button labeled alarm silence in the front face of the paralleling distribution equipment.		

E. Five Position Engine Control Switch Operation:

1. Provide a five-position engine control switch for each generator.
2. Provide labels with 1/4" letters for each switch position.
3. Stop/Reset: In this position, the engine shall not be capable of starting and/or running. If the engine was shut down due to the operation of a protective device, the shutdown malfunction shall be reset when the switch is moved to this position. If the engine is running when the switch is moved to this position, it shall be immediately shutdown.
4. Off/Cool down: In this position, the engine shall shutdown after a cooldown period.
5. Automatic: In this position, the engine control shall be in readiness for fully automatic operation upon receipt of a start signal.
6. Test Off-Line: When placed in this position, the engine shall start and run as if a start signal were received except it shall not be connected to the bus unless a start signal is received. When returned to the automatic position, the engine will shut down.
7. Test On-Line: When placed in this position, the engine shall start, run and connect to the bus as if a start signal were received. When returned to the "Automatic" position, the circuit breaker will open and the engine will run for its cool down period before shutting down.

F. Operator Panel: Provide an operator panel for each generator set. The generator operator panel shall provide the following information.

1. Provide the following instrumentation information for each generator: Amps, voltage L-L and L-N, frequency, watts, volt-amps, KWH, power factor, with a digital display.
2. Generator set mode indicating: manual operation, emergency, cool down, stop, lockout, or auto.

3. Other generator information: warnings, alarms, demand as a percentage of unit capacity.
 4. Screen to display control, data, performance, present run time, total run time, and all indications/alarm reported at the generator control panel.
 5. Engine cool down time: Adjustable 0-600 seconds. The control panel shall indicate the time remaining in the time delay period for each generator when the generator is timing for shutdown.
 6. Generator start time delay: Adjustable 0-60 seconds. The control panel shall indicate the time remaining in the time delay period when the generator is timing to start.
- G. Provide a visual indication of the status and position of each transfer switch at the main control panel of the paralleling distribution equipment.
1. Provide red LED for normal and emergency position.
 2. Provide SCADA diagram indicating switch position on LCD monitor.

2.10 MASTER CONTROL STATION DISPLAY

- A. Provide a system master control to monitor and control the operation of the entire paralleling distribution system and generator set controls.
- B. The master control station interface shall be displayed through a liquid crystal display LCD screen. LCD display shall be full color, high resolution, human machine interface (HMI). The screen shall be sized appropriately for the amount of system information, minimum 14-inch screen.
- C. Provide a redundant master control station display. The redundant screen will display all the same information as the primary screen.
- D. Components displayed on the HMI display shall be designated as indicated on the plans. The display shall include the following screens/functions.
1. Main Menu Screen: Provide a main menu for ease of navigation through the various screens. The display shall turn return to the main screen and the display shall turn off after 10 minutes without human input.
 2. One Line Diagram Screen: Provide a one-line diagram screen showing the system status of the following components by a combination of animation, changing color indicators, text messages, and pop up indicators.
 - a. Generators: (/), (/).
 - b. Paralleling distribution equipment: (/).
 - c. Automatic transfer switches including position: (/).
 - d. Generator circuit breaker with status indications.
 - e. Paralleling circuit breaker with status indication.
 - f. Other:

3. Generator Set Screen: Provide a generator set screen for each unit. Screen to display control, data, performance, present run time, total run time, and all indications/alarm reported at the generator control panel.
 - a. Provide the following instrumentation information for each generator: engine rpm, oil pressure, coolant temperature, DC voltage, engine hours, genset KW hours, number of starts, generator and bus line to line voltage on all phases, generator and busline to neutral voltage on all phases, generator and bus frequency, generator and load current, power factor, kVAR and kw, and power factor.
4. Load Control Screen: Provide a load control screen to display the following information and allow the following operations.
 - a. Display the paralleling bus capacity in KW, KVA, and amps.
 - b. Display the total load in KW, KVA, and amps.
 - c. Display loads served by priority level. Refer to drawings and operations systems operation portion of this section for complete list of priorities. In general, the priorities will be categorized as follows (priority 1 being most important).
 - 1) Priority 1: Life Safety Transfer Switches.
 - 2) Priority 2: Critical Power Transfer Switches.
 - 3) Priority 3: Equipment Power Transfer Switches.
 - 4) Priority 4: Equipment Power Transfer Switches.
 - d. Operation: Allow user to manually shed or restore loads from the display screen.
5. History and alarms screen: Provide a history and alarm screen which provides a history of all historical operations and alarms with time stamp. Provide capability of storing 100 events. New events shall override the oldest stored information after the log is full. The historical events screen shall not be allowed to be cleared or erased. Each event shall be logged by date, time, alarm description, and time of alarm acknowledgement.
6. The following functions may be provided on separate screens or included on the above screens.
 - a. Allow the operator to enable or disable load demand operation.
 - b. Initiate test (with or without load).
 - c. Control the shutdown sequence for the generator sets in the load demand mode.
 - d. Set the load demand time delays.
 - e. Set the load demand operation setpoints.
 - f. Display and modify the automatic load add and shed sequence.
 - g. Manually start and stop each generator.

- h. Generator set mode indicating: manual operation, emergency, cool down, stop, lockout, or auto.
 - i. Other generator information: warnings, alarms, demand as a percentage of unit capacity.
 - j. Trending information: Display KW, KVA, and frequency for each generator and the total load for the system.
 - k. Engine cool down time: Adjustable 0-600 seconds. The control panel shall indicate the time remaining in the time delay period for each generator when the generator is timing for shutdown.
 - l. Generator start time delay: Adjustable 0-60 seconds. The control panel shall indicate the time remaining in the time delay period when the generator is timing to start.
7. Security Log-in: Provide provisions for a security log-in function to prevent unauthorized use of the system. Provide three levels of access.
- a. Security Levels:
 - 1) Monitor only: Access to all status screens, history, and alarm logs. No access to set points, engine controls, circuit breaker controls, or system status functions.
 - 2) Monitor and Control: Access to system controls, functions, and basic system adjustable setpoints.
 - 3) Administrative Technician: Access to all set points including factory established set points and calibration.

2.11 MANUAL SYNCHRONIZING CONTROLS

- A. Provide manual synchronizing controls for each generator. The manual synch controls shall be provided separately from the LCD human machine interface.
- B. Provide a synch scope for each generator. The synch scope shall be a digital display, mechanical display in the face of the switchboard.
- C. Provide protective provisions so that the manual synch provisions will not allow a user to manually synch the generators in a dangerous situation which may damage the generators or paralleling equipment.
- D. Provide a separate LED indication in the switchboard for each generator to indicate successful synchronization.

2.12 SYSTEM OPERATION

- A. Normal Condition:
 - 1. Operate as a paralleling standby system for hospital essential systems.
 - 2. Under normal conditions, all generator breakers will be open, and the packaged engine generators will not be running.

3. The utility source will be supplying the entire load through the normal distribution system.
4. The automatic paralleling engine starting controls are placed in their automatic position and the engine generators are in a state of standby.

B. Automatic Mode:

1. Start signal from any transfer switch shall automatically start all engine generators which have not been locked out.
2. The first generator to reach 90% of rated voltage and frequency is connected to the emergency bus through its associated paralleling circuit breaker.
3. Electronic interlocks permit the connection of only one generator.
4. The transfer switches sense available emergency power.
5. Priority 1 and Priority 2 loads shall close to the emergency bus.
6. Priority 1 and Priority 2 loads shall be fully operational within 10 seconds or less after losing utility power.
7. The paralleling equipment shall maintain "transfer inhibit" output contact to inhibit other priority loads from transferring to the emergency bus until all generators are paralleled on the emergency bus.
8. The synchronizers shall automatically adjust the frequency of the other generators to achieve synchronism with the emergency bus. When within acceptable limits of synchronizing the on-coming generator shall close to the emergency bus through its associated paralleling circuit breaker.
9. When the generators are paralleled their governors shall be connected for load sharing operation.
10. Generators which have been locked out for maintenance or other reasons shall not inhibit the system from continuing past this step of the sequence.
11. The paralleling equipment shall release the "transfer inhibit" control of the remaining transfer switches in order of priority level. The in sequence the remaining transfer switches sense available emergency power and transfer to the emergency bus. Transfer Delays are listed in seconds from transfer delay of priority 1.
 - a. Priority 1 Legal Transfer Switch:
 - 1) Transfer to emergency delay (0 seconds).
 - 2) Transfer to utility normal delay (10 minutes).
 - 3) Load Shed allowed: No.
 - 4) Includes: Legal ATS
 - b. Priority 2: - Critical Power ODPA and ODPB:
 - 1) Transfer to emergency delay (0 seconds).
 - 2) Transfer to utility normal delay (10 minutes).
 - 3) Load Shed allowed: No.
 - 4) Includes: Breakers in Paralleling Gear

- c. Priority 3 Chiller #1
 - 1) Transfer to emergency delay (2 seconds).
 - 2) Transfer to utility normal delay (8 minutes).
 - 3) Load Shed allowed: Yes.
 - d. Priority 4: - Chiller #2
 - 1) Transfer to emergency delay (4 seconds).
 - 2) Transfer to utility normal delay (6 minutes).
 - 3) Load Shed allowed: Yes.
12. Utility (Normal) Power Returns:
- a. The transfer switch shall automatically transfer to the normal utility power source after utility power returns. Refer to the transfer to normal time delay settings listed in this section.
 - b. When all loads have been transferred to the normal utility and all start signals have been removed from the generator sets, the circuit breakers in the paralleling equipment for each generator set shall open. The generators shall operate at no load for a cool down period of 15 minutes. The cool down period shall be adjustable from 10-30 minutes.
 - c. The generators shall shut down after the cool down period.
 - d. If a system start signal is received during the cool down period the automatic operation sequence shall be initiated again.
13. Special Conditions:
- a. Bus under frequency relay shall initiate for bus frequency below 58 Hz. System PLC shall initiate "Load Shed" contact when bus under frequency condition is maintained for continuous 5 seconds. "Load Shed" contact shall initiate disconnecting from emergency source. Load shed operation shall require manual reset to restore shed transfer switches to emergency source.
 - b. Should an engine generator set fail to start, fail to automatically parallel or develop a critical running monitored fault, the control system shall cause the engine to automatically shut down with its circuit breaker automatically tripped open. The paralleling system would then load shed the lowest priority load in order of importance.
 - c. If the facility experiences a partial normal power outage, only those automatic transfer switches that are affected shall detect a power failure. This action shall prompt the system to automatically add the highest priority blocks of load, to the bus, that are experiencing a power failure. If subsequent normal power failures occur at other transfer switches the system shall automatically adjust the load add/shed schedule accordingly to keep as many higher priority loads connected as the generator capacity permits.
 - d. If the engine fails to start after 4 adjustable cranking attempts (factory set at 10 seconds on, 10 seconds off, adjustable from 5 to 30 seconds) or if any protective device should operate while the engine is running, the

engine shall be disconnected from service and immediately stopped. The engine control logic shall lock the failed set out of service and requires a manual reset. The engine control logic shall include a provision for conversion to single cycle cranking, adjustable from 35 to 210 seconds.

C. Manual Operation:

1. System in manual shall require manual initiating of engine/generators. Initiation from system PLC shall start and synchronize both generators. Initiation from each engine generator shall require manual synchronizing and paralleling.
2. Relay interlocks shall inhibit the manual paralleling of generators in an unsafe condition.
3. Relay interlocks shall inhibit the manual switching of automatic transfer switches in an unsafe condition.
4. System in manual shall disable system "Transfer Inhibit" and "Load Shed" functions.
5. Generator start signal from a transfer switch while system is in manual shall override system to automatic operation.

D. Test Mode:

1. The system shall allow the generators to be tested by transfer of the system loads to the generator sets from the transfer switches. Loads shall be transferred to the emergency power supply system similar to the automatic operation control sequence.

E. Generator Set Exercise (Test Without Load Mode):

1. The system shall allow testing of the generator sets at no load. In this operation mode the generator sets will start, build up to rated speed and voltage, synchronize and close to the generator bus, but system loads shall not automatically transfer to the generator system. If a power failure occurs during a test period, loads shall immediately close into the system on a priority basis.

F. Load Demand:

1. After all generator sets have been paralleled to the bus and all loads connected, a stabilization time delay (0-15 minutes) factory set at 15 minutes will be initiated. At the expiration of the time delay period, the system will operate in a load demand mode. The load demand control logic and its associated controls will control the number of generating sets on the bus, such that the on-line reserve capacity of the bus is not less than 10%, nor more than 120%, of the capacity of a single generator set.
2. Upon sensing that the connected load has decreased the reserve capacity to 10% or less, a 10-second time delay is initiated. this time delay will be field adjustable from 0-300 seconds. If the reserve capacity stays below 10% for the duration of the time delay, the controls will initiate the starting and paralleling of the next set in sequence. If, during the time delay period, the reserve capacity decreases to 0 or less (signifying bus overload), the time delay will be bypassed and the next set in sequence will be immediately started and paralleled. At the same time signals will be given to shed loads such that the connected priority blocks of load are

reduced to equal the number of engine generator sets on line. When the next set is paralleled to the bus, the shed load will be reconnected and all controls automatically reset.

3. Should the next set in sequence have its engine control switch in the "off" position or fail to synchronize within the preset time delay of the "fail-to-synchronize" timer, the controls will automatically pass the starting signal to the next set in sequence.
4. Upon sensing that the on-line reserve capacity has increased to 120% or more, a 180 second (adjustable 0-300 seconds) time delay will be initiated. If the reserve capacity stays above 120% for the duration of the time delay, the circuit breaker of the last set that went on line will be opened. The engine will run for its cool down period, then shutdown.
5. The paralleling equipment shall "transfer inhibit" any set of priority loads and the associated transfer switches from connecting to the emergency bus if the respective priority load has been shed twice during the same power outage. The transfer inhibit signal will remain in effect unless reset manually or reset automatically after all transfer switches have returned to the utility (normal) power source.

2.13 ACCESSORIES

- A. DC Control Power: Diode power supply for best battery arrangement connection to both engine battery systems.
- B. Auxiliary Contacts:
 1. Provide 2 N.O., 2 N.C. spare independent auxiliary contacts, 120 volt, 10 amp, which change state when each diesel generator is to start. Reverse state when units are to stop. Provide separate contacts in paralleling equipment for each unit.
- C. Emergency Power Off Switch (EPO): The emergency stop switch shall be red, mushroom head switch, with protective Lexan cover, mounted in the face of the main control panel of the paralleling distribution equipment.
- D. Paralleling Switchgear Remote Annunciator Panel:
 1. Remote annunciator to duplicate all points as specified in generator control section. Remote annunciator shall be powered from the paralleling distribution equipment.
 - a. Located as shown on drawings.
- E. Portable Generator / Load Bank Operation – A control station shall be provided on the master section that allows for control of single breaker being provided for load banking / portable generator operation.
 1. Control shall be via a key operated three position control selector switch allowing for one of three positions: Off, Load Bank and Portable Gen
 2. Off – Load Bank / Portable Operation is turned off and the breaker is open
 3. Load Bank – Breaker closes and allows power to be exported from the parallel generators to the load bank located elsewhere. Control wiring

shall be provided to turn load bank off if an emergency start signal is received from any transfer switch.

4. Portable Gen – Breaker closes and allows power to be imported from the portable generator to power the emergency loads. The permanent generator breakers shall open and programming shall prevent the starting and paralleling of the permanent generators as well as closing of the permanent generator breakers even if a start signal is received. Portable generator controls shall be provided for start/stop controls.
5. A control terminal block shall be provided for all controls to land on.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install distribution paralleling equipment in accordance with manufacturer's written guidelines and instructions.
- B. Installation of equipment shall include all interconnecting wiring between equipment provided for the emergency power supply system. The contractor shall also provide interconnecting wiring between equipment sections when required, under the supervision of the equipment supplier.
- C. Verify adequate clearance to paralleling and distribution switchboard equipment prior to installation.
- D. Install paralleling and distribution switchboard on concrete housekeeping pads. Inspect concrete pads for level prior to installation.
- E. Tighten accessible bus connections and mechanical fasteners after placing switchboard.
- F. Install fuses.

3.2 INSTALLATION OF CONTROLS FURNISHED BY ENGINE-GENERATOR SUPPLIER

- A. Switchgear manufacturer shall mount and wire all electronic and electric controls associated with the engine-generator set governor and voltage regulator as described in the engine-generator set specifications. Controls may include, but not be limited to:
 1. Electronic control portion of governor.
 2. Frequency adjust potentiometer.
 3. Cross current compensation transformer.

3.3 FIELD QUALITY CONTROL

- A. Inspect completed installation for physical damage, proper alignment, anchorage and grounding.
- B. Measure insulation resistance of each bus section phase to phase and phase to ground for one minute each. Test voltage shall be 1000 volts, and a minimum acceptable value for insulation resistance is 2 megohms.
- C. Check tightness of accessible bolted bus joints using a calibrated torque wrench. Tightness shall be in accordance with manufacturer's recommended values.

- D. The Factory Technician shall perform the following series onsite:
1. Verify contractor connections, control power availability, visually inspect relay settings, verify megger test of the generator cables and the main bus.
 2. With the engine generator supplier's technical representative controlling the engine, verify that the switchgear and control equipment are fully operational and perform per the sequence of operation specified. Equipment or services required for load or performance testing of the engines shall be provided by the engine generator set supplier.
 3. With the engine generator supplier's technical representative controlling the engine, demonstrate all functions of the control system, both automatic and manual.
 4. Provide documentation in the form of function checklists and recorded data for each section to the approving Architect/Engineer.

3.4 ADJUSTING AND CLEANING

- A. Provide field services as required in conjunction with manufacturer for system start-up and testing as described in Section 23 32 13.
- B. Verify proper phase rotation between the individual generators of the emergency power system and the utility source.
- C. Adjust all operating mechanisms for free mechanical movement.
- D. Touch up scratched or marred surfaces to match original finish.
- E. Adjust trip and time delay settings to values as scheduled, or as instructed by the Architect/Engineer.
- F. Make necessary adjustment and debugging at terminal locations to obtain correct data and access for revising set points for operation.

3.5 RELAY COORDINATION

- A. The switchboard supplier and contractor shall be responsible for relay coordination of generator protection package as required for reliable system operation and equipment protection. All documentation and settings shall be submitted to the Architect/Engineer for review prior to start-up.

3.6 SYSTEM COMMISSIONING (ON-SITE ACCEPTANCE TESTING)

- A. The complete installation shall be tested for compliance with the specification following completion of all the complete emergency power supply system.
- B. The date and times for the system commissioning shall be coordinated to allow representatives from the following groups to attend: Owner representatives, Architect/Engineer, appropriate contractors, factory representatives. The contractor and factory representatives shall actually conduct the tests as outlined in the commissioning report.
- C. The requirements associated with the emergency power supply system commissioning report shall be provided by the Architect/Engineer prior to the test. The detailed

requirements of the test have not been included in this section. In general, the requirements will include the following items:

1. Explanation of emergency power supply system for owner's representatives.
2. Cold start test of the generators.
3. Simulated utility power outage.
4. Two-hour full load test of each generator; generator supplier shall provide load banks
5. One step rated load pickup test in accordance with NFPA 110.
6. Simulate power outage at each transfer switch.
7. Verify successful automatic restart of all mechanical, electrical, and other systems which are connected to the emergency power system after a simulated power outage. Example: Motors shall be tested for proper phase rotation, VFDs programming shall be tested for automatic restart.
8. Onsite commissioning shall include all load banks, cables, cable ramps, and any other associated equipment required to functional test all paralleling controls and load sharing functions at various kW load levels (as recommended by equipment manufacturer). All equipment shall remain onsite at the expense of the generator supplier until functional testing is successfully completed. Typical onsite time will be two weeks.

3.7 FUNCTIONAL TESTING (WITNESS TESTING AT FACTORY)

- A. Paralleling gear manufacturer shall coordinate with generator manufacturer for conducting a fully functioning test of the gear and the generator sets at the factory.
- B. The equipment shall be factory tested to simulate a complete and integrated system. The circuit breakers supplied shall be installed in their actual positions and electrically and mechanically tested. A narrative of the system operation shall be provided and shall be used when testing the equipment. Copies of the test reports shall be submitted to the Architect/Engineer.
- C. Electrical Contractor shall notify Owner, Architect, and Engineer a minimum of 2 weeks prior to functional testing in order to be available to witness testing. Travel expenses for the Owner, Architect, and Engineer, including meals and lodging, shall be the responsibility of the Electrical Contractor.
- D. Functional test shall simulate field installed conditions including transfer switch controls, load shedding, load sense demand and fault conditions. Testing shall include, not limited to, the following:
 1. Connect genset to fuel source in testing area.
 2. Witness of test shall be at engine dealer discretion; however; any transportation, lodging, or meals for these personnel shall be the responsibility of the requesting personnel.
 3. Disconnect after test.
 4. Touch up paint and prepare for shipment.

- E. The following tests shall be documented prior to the witness test:
1. Dielectric Test (Per ANSI C37.20.2, 5.3.1).
 2. Mechanical Test (Per ANSI C37.20.2, 5.3.2).
 3. Grounding of Instrument Transformer Case Test (Per ANSI C37.20.2, 5.3.3).
 4. Electrical Operation and Control Wiring Test (Per ANSI C37.20.2, 5.3.4.1).
 5. Polarity Test (Per ANSI C37.20.2, 5.3.4.3).
 6. Sequence Test (Per ANSI C37.20.2, 5.3.4.4).
- F. Manufacturer shall include all airfare, travel, & lodging expenses for up to 4 owner representatives.

END OF SECTION

SECTION 263214 STATIONARY LOAD BANK WITH AUTOMATIC LOAD LEVELING CONTROL

PART 1 - GENERAL

1.1 SCOPE

- A. This specification contains the minimum requirements for the design, manufacture and testing of a UL listed, air-cooled, outdoor weatherproof resistive load bank.
- B. The load bank is required for periodic exercising and testing of the (standby) emergency power source. The load bank shall be permanently mounted in a weatherproof enclosure, forced air cooled with remotely mounted control panel.
- C. This specification shall apply if the load bank is supplied to the purchaser, or as a part of other equipment.
- D. Should the vendor take exception to any part of this specification, it shall be stated in the bid, and referenced to the specification line number.

1.2 SUBMITTALS

- A. The manufacturer shall submit for review technical data including features, performance, electrical characteristics, physical characteristics, ratings, accessories, and finishes.
- B. Shop drawings shall include dimensional plans, front and side elevations and mounting details sufficient to properly install the load bank. Load bus configuration and load connections termination area shall be clearly identified.
- C. Electrical schematic drawings shall be provided to detail the operation of the load bank and the provided safety circuits. Over-current protection and control devices shall be identified and their ratings marked. A system interconnection drawing shall be included for control wiring related to the load bank.

1.3 STANDARDS

- A. The equipment covered by this specification shall be designed with the latest applicable NPFA-70 NEMA, NEC, IEEE, and ANSI standards.
- B. The load bank certified to a NRTL such as UL or CSA.

PART 2.0 PRODUCTS

2.1 RATINGS

- A. The total capacity of the load bank shall be rated **1100kW** at 480 Volts, 3-Phase, 3-Wire, 60 Hertz, at unity Power Factor and 50 kW minimum load step resolution.

2.2 MATERIAL AND CONSTRUCTION

- A. Provide a UL Listed, Free-Standing, Outdoor Resistive Load Bank. The load bank shall be suitable for installation in the following ambient conditions:
 - Wind Loading: 75 MPH
 - Seismic Rating: Zone 4
 - Ambient Temperature: -20°F to +120°F

Altitude: 5,000 feet above sea level

- B. The load bank will be rated for a continuous duty cycle at 1100kw KW at 480 Volts AC, 3-phase, 60 Hertz. The Load Step Resolution shall be approximately 10 percent of the total load bank capacity.
- C. The load bank shall be a completely self-contained, freestanding unit which includes all resistive load elements, load control devices, load element branch circuit fuse protection, main load bus, control terminals, system protection devices and NEMA type enclosure.
- D. The load bank is designed for installation and operation in an outdoor environment with sufficient fresh intake air available, while secured to a flat surface such as a roof, finished floor or concrete pad. Cooling air is drawn in from the screened air-intake sides, with hot air vertically exhausted from the top of the unit away from personnel. The load bank enclosure shall be constructed of galvanized steel with powder coat paint finish with exterior stainless steel fasteners. Dead front access to all electrical and mechanical connections shall be provided.
- E. All power connections including main-input load bus, external bower power, operator remote control, instrumentation and customer interface connections are made within the enclosed relay/connection compartment. Bottom access through a removable gland plate provides a "safe and sealed" ease of installation of all conduit entry cable. Load connections are made directly to the main input load bus bars. A standard NEMA 4-hole pattern shall be provided for customer load cables connections. All copper bus bars are plated for superior oxidation resistance. Relay/connection compartment is heated and thermostatically controlled to limit any harmful effects of condensation.
- F. The load bank shall have a sound level of 80 dB(A) or less at a distance of 23 feet.
- G. The load bank will cooled by an integrally mounted blower system. The system will include a TEFC motor with high-performance, direct-driven fan blade. The Blower can be powered from an external 3-phase supply source, or internally from the main input load bus (source under test).
- H. The load bank control circuits will be operated at 120 VAC AC, 1-phase. The control power will be derived from a control transformer connected to the bower circuit. The Control Transformer will be primary and secondary fuse protected.
- I. Resistor load element provide the necessary KW load rating for each load step. Resistors are fully supported across their entire length within the air stream by stainless steel support rods which are insulated with heavy-duty, high temperature ceramic insulators. The change in resistance is minimized by maintaining conservative resistor designs.

- J. Branch circuit fuse protection provides short-circuit protection of all load steps. Fuses are fast-acting, current-limiting type with an interrupting rating of 200K A.I.C.
- K. The load bank will include safety circuits which will disable the load bank if an over-temperature or loss of air flow condition occur. The Blower Motor is short circuit protected by current limiting fuses and thermally protected by overload relay. Load cannot be reapplied until the fault condition is corrected.
- L. Load Bank Control Panel will be installed in a NEMA wall mountable enclosure. The control panel will include; Main Power On/Off switch, Blower Start/Stop push buttons, Master Load On/Off switch, and Individual Load Step switches KW On/Off). Illuminated indicators provide Power On, Blower On, Motor Overload, Air-Flow Failure, Over-Temperature and Load Dump. An Emergency-Stop (E-STOP) push button is provided to disable control power voltage to all operator control circuits, including blower and load application circuits.
- M. Automatic Load Leveling Control will add/subtract load bank load in response to dynamic power fluctuations of the connected building load. It utilizes the load bank as a supplemental load for maintaining a minimum load on the power source. A customer supplied "transfer of control" contact closure initiates the load bank and time delay load application circuit. A separately supplied current transformer provides the necessary feedback signal for sensing the building load.
- N. Automatic Load Dump circuit provides user interface provisions to the generator controls, automatic transfer switch or building management system, to disconnect and disable all load steps from a normally closed (NC) set of auxiliary contacts. In the event of an actual power failure, all load bank load is removed from the source under test.
- O. Remote Indication and Alarm contact closure [form-c-type, normally open and normally closed] provides user interface to building management system for indication, detection and alarm of Air-Flow Failure, Over-Temperature and Load Dump.
- P. The load bank will be manufactured by Load Banks Direct, Avtron or approved equal.

PART 3.0 EXECUTION

3.1 QUALITY CONTROL

- A. The load bank shall be fully tested using a test specification written by the supplier. Tests shall include electrical functional testing, verifying conformance to assembly drawings and specifications. Each load step shall be cold resistance checked to verify proper calibration of resistive load steps and proper ohmic value.

- B. The manufacturer shall maintain this data on file for inspection purposes by the purchaser. Tests using high potential equipment shall be performed to ensure isolation of the load circuits from the control circuits and to determine isolation of the load circuits from the load bank frame. Tests of all safety circuits shall be performed to verify conformance to the specification.
- C. All electrical circuits shall have a high potential insulation resistance test performed at twice rated voltage plus 1000 VAC to assure insulation integrity.
- D. All quality control test equipment shall be regularly maintained and calibrated to traceable national standards.
- E. The Company's Quality System shall be at least ISO9001:2015 Certified.

3.2 QUALIFICATIONS OF MANUFACTURER

- A. The load bank shall be manufactured by a firm regularly engaged in the manufacture of load banks and who can demonstrate at least twenty five (25) years of experience with at least twenty five (25) installations of load banks similar or equal to the ones specified herein.
- B. The manufacturer shall have a written Quality Control procedure available for review by the purchaser, which shall document all phases of operations, engineering, and manufacturing.

END OF SECTION 263214

SECTION 263353 - STATIC UNINTERRUPTIBLE POWER SUPPLY

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

- 1. Modular N+1 UPS#1 (40KVA/36KW) capable of being upgradeable to 50KVA by addition of UPS modules within the same cabinet. Each UPS module shall be rated 10KVA.
- 2. Modular N+1 UPS#2 (40KVA/36KW) capable of being upgradeable to 50KVA by addition of UPS modules within the same cabinet
- 3. Provide with the following features with each UPS:
 - a. Surge suppression.
 - b. Input harmonics reduction.
 - c. Rectifier-charger.
 - d. Inverter.
 - e. Static bypass transfer switch.
 - f. Battery and battery disconnect device.
 - g. Remote UPS monitoring provisions via network communication card.

1.3 DEFINITIONS

- A. EMI: Electromagnetic interference.
- B. LCD: Liquid-crystal display.
- C. LED: Light-emitting diode.
- D. THD: Total harmonic distortion.
- E. UPS: Uninterruptible power supply.

1.4 ACTION SUBMITTALS

- A. Seismic Performance: UPS shall withstand the effects of earthquake motions determined according to ASCE.
 - 1. The term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified and the unit will be fully operational after the seismic event."
- B. Product Data: For each type of product indicated. Include data on features, components, ratings, and performance.
- C. Shop Drawings: For UPS. Include plans, elevations, sections, details, and attachments to other work.
 - 1. Detail equipment assemblies and indicate dimensions, weights, components, and location and identification of each field connection. Show access, workspace, and clearance requirements; details of control panels; and battery arrangement.

1.5 INFORMATIONAL SUBMITTALS

- A. Manufacturer Certificates: For each product, from manufacturer.
- B. Factory Test Reports: Comply with specified requirements.
- C. Field quality-control reports.
- D. Performance Test Reports: Indicate test results compared with specified performance requirements and provide justification and resolution of differences if values do not agree.
- E. Warranties: Sample of special warranties.

1.6 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For UPS units to include in emergency, operation, and maintenance manuals.

1.7 MAINTENANCE MATERIAL SUBMITTALS

- A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
 - 1. Fuses: One for every 10 of each type and rating, but no fewer than one of each for each UPS set.
 - 2. Cabinet Ventilation Filters: One complete set(s) for each UPS set.

1.8 QUALITY ASSURANCE

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- B. UL Compliance: Listed and labeled under UL 1778 by an NRTL.
- C. Reliability: The UPS equipment reliability shall be represented in terms of theoretical Mean-Time-Between-Failures (MTBF). The UPS manufacturer shall, as a minimum provide the following capability:
 - 1. Total single module UPS system output (includes reliability of bypass circuit) is 1,8000,000 MTBF hours.
 - 2. Single module UPS operation (represents UPS module operation only): 233,000 MTBF hours.
 - 3. Maintainability: Mean Time to Repair (MTTR) of the UPS shall not exceed one (1) hour including time to replace components.

1.9 WARRANTY

- A. Special UPS Warranties: Specified form in which manufacturer and Installer agree to repair or replace components that fail in materials or workmanship within special warranty period.
 - 1. Special Warranty Period: One year from date of Factory Startup for UPS and one year from date of Factory Startup for batteries.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. The Basis of Design is:
 - 1. Mitsubishi.
- B. Substitutions shall be submitted 10 days prior to bid date to the Engineer with a list of any deviations or exceptions to this specification.

2.2 OPERATIONAL REQUIREMENTS

- A. Automatic operation includes the following:
 - 1. Normal Conditions: Load is supplied with power flowing from the normal power input terminals, through the rectifier-charger and inverter, with the battery connected in parallel with the rectifier-charger output.

2. Abnormal Supply Conditions: If normal supply deviates from specified and adjustable voltage, voltage waveform, or frequency limits, the battery supplies energy to maintain constant, regulated inverter power output to the load without switching or disturbance.
3. If normal power fails, energy supplied by the battery through the inverter continues supply-regulated power to the load without switching or disturbance.
4. When power is restored at the normal supply terminals of the system, controls automatically synchronize the inverter with the external source before transferring the load. The rectifier-charger then supplies power to the load through the inverter and simultaneously recharges the battery.
5. If the battery becomes discharged and normal supply is available, the rectifier-charger charges the battery. On reaching full charge, the rectifier-charger automatically shifts to float-charge mode.
6. If any element of the UPS system fails and power is available at the normal supply terminals of the system, the static bypass transfer switch switches the load to the normal ac supply circuit without disturbance or interruption.
7. If a fault occurs in the system supplied by the UPS, and current flows in excess of the overload rating of the UPS system, the static bypass transfer switch operates to bypass the fault current to the normal ac supply circuit for fault clearing.
8. When the fault has cleared, the static bypass transfer switch returns the load to the UPS system.
9. If the battery is disconnected, the UPS continues to supply power to the load with no degradation of its regulation of voltage and frequency of the output bus.

B. Manual operation includes the following:

1. Turning the inverter off causes the static bypass transfer switch to transfer the load directly to the normal ac supply circuit without disturbance or interruption.
2. Turning the inverter on causes the static bypass transfer switch to transfer the load to the inverter.

C. Three-breaker wrap around Maintenance Bypass/Isolation Switch with electrical interlocks – SKRU.

D. Environmental Conditions: The UPS shall be capable of operating continuously in the following environmental conditions without mechanical or electrical damage or degradation of operating capability, except battery performance.

1. Ambient Temperature for Electronic Components: 32 to 104 degrees F.
2. Ambient Temperature for Battery: 41 to 95 degrees F.
3. Relative Humidity: 5 to 95 percent, noncondensing.
4. Altitude: Sea level to 5000 feet.

2.3 PERFORMANCE REQUIREMENTS

- A. The UPS shall perform as specified in this article while supplying rated full-load current, composed of any combination of linear and nonlinear load, up to 100 percent nonlinear load

with a load crest factor of 2.5, under the following conditions or combinations of the following conditions:

1. Inverter is switched to battery source.
 2. Steady-state ac input voltage deviates up to plus or minus 10 percent from nominal voltage.
 3. Steady-state input frequency deviates up to plus or minus 5 percent from nominal frequency.
 4. THD of input voltage is 15 percent or more with a minimum crest factor of 2.5, and the largest single harmonic component is a minimum of 5 percent of the fundamental value.
 5. Load is 30 percent unbalanced continuously.
 6. Supply a single input connection.
- B. Minimum Duration of Supply: If battery is sole energy source supplying rated full UPS load current at 90 percent power factor, duration of supply is 10 minutes.
- C. Input Voltage Tolerance: System steady-state and transient output performance remains within specified tolerances when steady-state ac input voltage varies plus 15, minus 30 percent from nominal voltage.
- D. Overall UPS Efficiency: Equal to or greater than 93.0 percent at 100 percent load and 93.0 percent at 50 percent load.
- E. Maximum AC Output-Voltage Regulation for Loads up to 100 Percent Unbalanced: Plus or minus 2 percent over the full range of battery voltage.
- F. Output Frequency: 60 Hz, plus or minus 0.01 percent over the full range of input voltage, load, and battery voltage.
- G. Limitation of harmonic distortion of input current to the UPS shall be as follows:
1. Description: Either a tuned harmonic filter or an arrangement of rectifier-charger circuits shall limit THD to less than 4 percent, at rated full UPS load current, for power sources with X/R ratio between 2 and 30.
- H. Maximum Harmonic Content of Output-Voltage Waveform: 2 percent maximum at 100 percent linear load, 5 percent maximum at 100 percent non-linear load.
- I. Minimum Overload Capacity of UPS at Rated Voltage: 125 percent of rated full load for 60 seconds, and 150 percent for 30 seconds in all operating modes.
- J. Maximum Output-Voltage Transient Excursions from Rated Value: For the following instantaneous load changes, stated as percentages of rated full UPS load, voltage shall remain within stated percentages of rated value and recover to, and remain within, plus or minus 3 percent of that value within 100 ms:
1. 50 Percent: Plus or minus 3 percent, recovery in less than 1 cycle.
 2. 100 Percent: Plus or minus 3 percent, recovery in less than 1 cycle.
 3. Loss of AC Input Power: Plus or minus 1 percent.

4. Restoration of AC Input Power: Plus or minus 1 percent.

- K. Input Power Factor: A minimum of 0.98 lagging when supply voltage and current are at nominal rated values and the UPS is supplying rated at 50 percent and 100 percent load.
- L. EMI Emissions: Comply with FCC Rules and Regulations and with 47 CFR 15 for Class A equipment.

2.4 UPS SYSTEMS

- A. Electronic Equipment: Solid-state devices using hermetically sealed, semiconductor elements. Devices include rectifier-charger, inverter, static bypass transfer switch, and system controls.
- B. Enclosures: Comply with NEMA 250, Type 1, unless otherwise indicated.
- C. Control Assemblies: Mount on modular plug-ins, readily accessible for maintenance.
- D. Surge Suppression: Components shall be protected from surges at the panel level, refer to specification 264313 "Surge Protection for Low-Voltage Electrical Power Circuits."

2.5 RECTIFIER-CHARGER

- A. Capacity: Adequate to supply the inverter during rated full output load conditions and simultaneously recharge the battery from fully discharged condition to 95 percent of full charge within 10 times the rated discharge time for duration of supply under battery power at full load.
- B. Output Ripple: Limited by output filtration to less than 0.5 percent of rated current, peak to peak.
- C. Control Circuits: Immune to frequency variations within rated frequency ranges of normal and emergency power sources.
 - 1. Response Time: Field adjustable for maximum compatibility with local generator-set power source.
- D. Battery Float-Charging Conditions: Comply with battery manufacturer's written instructions for battery terminal voltage and charging current required for maximum battery life.

2.6 INVERTER

- A. Description: Utilize fully Insulated Gate Bipolar Transistor (IGBT) inverter and Pulse Width Modulation (PWM) controls.

2.7 STATIC BYPASS TRANSFER SWITCH

- A. Description: Solid-state switching device providing uninterrupted transfer. A contactor or electrically operated circuit breaker automatically provides electrical isolation for the switch.
- B. Switch Rating: Continuous duty at the rated full UPS load current, minimum.

2.8 BATTERY

- A. Description: Valve-regulated, premium, heavy-duty, recombinant, lead-calcium units; factory assembled in a separate matching cabinet, complete with battery disconnect switch. The battery disconnect switch shall be sized to handle the maximum rating of the UPS.

2.9 HOT SWAPPABLE

- A. The Power Converter modules and battery modules shall be designed draw out hot swappable modules.

2.10 CONTROLS AND INDICATIONS

- A. Description: Group displays, indications, and basic system controls on a common control panel on front of UPS enclosure.
- B. Operation/Display Panel: The control panel shall employ the use of a 3.4" touch screen interface which allows lockout of all UPS control functions for security. (The Emergency Power Off function shall not be locked out.
 - 1. The operator interface shall provide the following:
 - a. UPS start-up procedure.
 - b. UPS shutdown procedure.
 - c. Emergency Power Off (EPO).
 - d. Audible alarm silence.
 - e. System status levels.
 - 2. The UPS shall be provided with a control/indicator panel. The panel shall be on the front of the UPS module. Controls, Meters, alarms and indicators for operation of the UPS shall be on this panel.
- C. Graphic Operator Terminal 3.4" Liquid Crystal Display (LCD)
- D. The LCD touch screen interfaces with the UPS system control and main processor board to provide menu-driven operator instructions and UPS system operation detail. The LCD indicates system operation, operational guidance, measurement data, set-up data, alarm messages and logs. All metering shall be digitally displayed on the LCD having and accuracy of 1% or better.

- E. The touch screen area is composed of one MAIN sheet and eight MENU sheets: MAIN, METER, OPERATION, STATUS LOG, BATTERY LOG, SETUP, the power converter module STATUS, CURRENT and FAULT LOG.
- F. MAIN Sheet: The MAIN sheet indicates power flow and measured values. The LCD panel allows the user to verify the status and operation of the UPS components by the mimic display. The following information is available on the MAIN sheet:
 - 1. Converter operation.
 - 2. Battery operation.
 - 3. Load on inverter.
 - 4. Load on bypass.
 - 5. Typical measurement values on Input, Bypass, Battery and Output.
 - 6. Alarm/Fault messages.
- G. Meter Sheet: The METER sheet indicates measured values. The following information is available on the METER sheet.
 - 1. Display information:
 - a. Input Voltage and Frequency.
 - b. Battery Voltage and Charging/Dis-charging Current.
 - c. Output Voltage, Frequency and Current.
 - d. Output active power.
 - e. Output power factor.
- H. OPERATION Sheet: The OPERATION sheet prompts the user to select specific performance.
 - 1. The Power Converter Module Start.
 - 2. The Power Converter Module Stop.
 - 3. Load transfer to Bypass.
 - 4. Load transfer to Inverter.
- I. STATUS MENU Sheet: The STATUS MENU Sheet indicates event and alarm/fault information. A minimum of 100 events can be displayed. The following alarm/status information shall be available as a minimum:
 - 1. Load on Inverter
 - 2. Load on Bypass
 - 3. System Startup
 - 4. System Stop
- J. Emergency Power Off Switch: Capable of local operation and operation by means of activation by external dry contacts.

2.11 MAINTENANCE BYPASS/ISOLATION SWITCH

- A. Description: Manually operated switch or arrangement of switching devices with mechanically actuated contact mechanism arranged to route the flow of power to the load around the rectifier-charger, inverter, and static bypass transfer switch.
 - 1. Switch shall be electrically and mechanically interlocked to prevent interrupting power to the load when switching to bypass mode.
 - 2. Switch shall electrically isolate other UPS components to permit safe servicing.
- B. Mounting Provisions: Internal to system cabinet.

2.12 MECHANICAL DESIGN

- A. Cabinet Structure (Enclosure)
 - 1. The enclosure shall be primed and painted with the Munsell N1.5 (black) color. The enclosure shall be free standing floor mount design. The enclosure panels shall consist of non-flammable plastic. The inside cover and frame shall consist of minimum 16-gage (1.5mm) steel for maximum strength and durability.
 - 2. The UPS shall be installed in cabinets of heavy-duty structure meeting with NEMA standard for floor mounting. Caster with locking point and leveling feet shall be included as a standard feature. Operating controls shall be located on the front panel of the UPS module. Input, output, and external battery cables shall be installed through the bottom of the cabinet.
- B. Serviceability
 - 1. The UPS shall have front access for all servicing adjustments and connections only for maintenance or service. Side access or rear access shall not be accepted. The UPS shall be designed such that it's sides can be pressed against side and rear walls.
 - 2. Cabinets shall be matching for front and rear alignment.
- C. Ventilation
 - 1. Forced air cooling shall be provided to allow all components to operate within their rated temperature window. Forced air shall be provide with redundant high-quality fans. All air inlets use air filters that shall be removable from the front of the UPS without exposure to any electrical hazard. Air filters shall be front cover mounted to prevent floor dust from being sucked into the unit.

2.13 MONITORING BY REMOTE COMPUTER

- A. Description: Communication module in unit control panel provides capability for remote monitoring of status, parameters, and alarms specified in "Controls and Indications" Article. The remote computer and the connecting signal wiring are not included in this Section. Include the following features:

1. Connectors and network interface units for data transmission.
2. The UPS shall be supplied with a Network Communication Card to enable the UPS to be monitored remotely via a TCP/IP network. This will provide real time monitoring of the UPS condition, status of voltages and currents, review error logs, and receive email notifications (SNMP traps) of errors as they occur. In addition, it will provide the ability to perform remote server shut-downs.
3. Software designed for control and monitoring of UPS functions and to provide on-screen explanations, interpretations, diagnosis, action guidance, and instructions for use of monitoring indications and development of meaningful reports. Permit storage and analysis of power-line transient records. Designs for Windows applications, software, and computer are not included in this Section.

2.14 SOURCE QUALITY CONTROL

- A. Factory test complete UPS system before shipment. Use simulated battery testing. Include the following:
 1. Test and demonstration of all functions, controls, indicators, sensors, and protective devices.
 2. Full-load test.
 3. Transient-load response test.
 4. Overload test.
 5. Power failure test.
- B. Report test results. Include the following data:
 1. Description of input source and output loads used. Describe actions required to simulate source load variation and various operating conditions and malfunctions.
 2. List of indications, parameter values, and system responses considered satisfactory for each test action. Include tabulation of actual observations during test.
 3. List of instruments and equipment used in factory tests.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine areas and conditions, with Installer present, for compliance with requirements for conditions affecting performance of the UPS.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Equipment Mounting: Install UPS on concrete base. Comply with requirements for concrete base specified in Section 033000 "Cast-in-Place Concrete".

1. Install dowel rods to connect concrete base to concrete floor. Unless otherwise indicated, install dowel rods on 18-inch centers around the full perimeter of concrete base.
 2. For supported equipment, install epoxy-coated anchor bolts that extend through concrete base and anchor into structural concrete floor.
 3. Place and secure anchorage devices. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
 4. Install anchor bolts to elevations required for proper attachment to supported equipment.
- B. Maintain minimum clearances and workspace at equipment according to manufacturer's written instructions and NFPA 70.
- C. Connections: Interconnect system components. Make connections to supply and load circuits according to manufacturer's wiring diagrams unless otherwise indicated.

3.3 GROUNDING

- A. Separately Derived Systems: If not part of a listed power supply for a data-processing room, comply with NFPA 70 requirements for connecting to grounding electrodes and for bonding to metallic piping near isolation transformer.

3.4 IDENTIFICATION

- A. Identify components and wiring according to Section 260553 "Identification for Electrical Systems."

3.5 BATTERY EQUALIZATION

- A. Equalize charging of battery cells according to manufacturer's written instructions. Record individual-cell voltages.

3.6 FIELD QUALITY CONTROL

- A. Perform tests and inspections.
1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.
- B. Tests and Inspections:
1. Comply with manufacturer's written instructions.
 2. Inspect interiors of enclosures, including the following:

- a. Integrity of mechanical and electrical connections.
 - b. Component type and labeling verification.
 - c. Ratings of installed components.
 - 3. Test manual and automatic operational features and system protective and alarm functions.
 - 4. Test communication of status and alarms to remote monitoring equipment.
 - a. Test battery-monitoring system functions.
 - C. The UPS system will be considered defective if it does not pass tests and inspections.
 - D. Record of Tests and Inspections: Maintain and submit documentation of tests and inspections, including references to manufacturers' written instructions and other test and inspection criteria. Include results of tests, inspections, and retests.
 - E. Prepare test and inspection reports.
- 3.7 DEMONSTRATION AND TRAINING
- A. Demonstrate to Owner the operation of the UPS under fully loaded conditions.
 - B. Train Owner's maintenance personnel to adjust, operate, and maintain the UPS. At the time of startup. Notice is to be given to the Owner ten (10) working days ahead of startup to allow for scheduling of the training. Include training materials with Operation and Maintenance Manual.

END OF SECTION 263353

SECTION 264313 - SURGE PROTECTION FOR LOW-VOLTAGE ELECTRICAL POWER CIRCUITS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section includes field-mounted SPDs for low-voltage (120 to 600 V) power distribution and control equipment.
 - 1. Main Paralleling Gear 'MDPA' – 480/277V, 3-phase, 4-wire.
 - 2. Emergency Distribution Panel 'DP-L' - 480/277V, 3-phase, 4-wire.
 - 3. Emergency Distribution Switchboard 'ODPA' - 480/277V, 3-phase, 4-wire.
 - 4. Emergency Distribution Switchboard 'ODPB' - 480/277V, 3-phase, 4-wire.
 - 5. Lighting Panel 'L1P' – 208/120V, 3-phase, 4-wire.
 - 6. Lighting Panel 'L2P' - 208/120V, 3-phase, 4-wire.
 - 7. Lighting Panel 'E1PA' - 208/120V, 3-phase, 4-wire.
 - 8. Lighting Panel 'E1PB' - 208/120V, 3-phase, 4-wire.
 - 9. Lighting Panel 'E1PC' - 208/120V, 3-phase, 4-wire.
 - 10. Lighting Panel 'E1PD' - 208/120V, 3-phase, 4-wire.
 - 11. Lighting Panel 'E2PA' - 208/120V, 3-phase, 4-wire.
 - 12. Lighting Panel 'E2PB' - 208/120V, 3-phase, 4-wire.
 - 13. Lighting Panel 'E2PC' - 208/120V, 3-phase, 4-wire.
 - 14. Lighting Panel 'E2PD' - 208/120V, 3-phase, 4-wire.
 - 15. Lighting Panel 'E2PE' - 208/120V, 3-phase, 4-wire.
 - 16. Lighting Panel 'E3PA' - 208/120V, 3-phase, 4-wire.
 - 17. Lighting Panel 'E4PA' - 208/120V, 3-phase, 4-wire.
 - 18. Lighting Panel 'E4PB' - 208/120V, 3-phase, 4-wire.
 - 19. Lighting Panel 'E5PA' - 208/120V, 3-phase, 4-wire.
 - 20. Lighting Panel 'E5PB' - 208/120V, 3-phase, 4-wire.
 - 21. Lighting Panel 'U1R' - 208/120V, 3-phase, 4-wire.
 - 22. Lighting Panel 'U2R' - 208/120V, 3-phase, 4-wire.

1.3 REFERENCED STANDARDS

- A. IEEE C62.41: IEEE Guide for Surge Voltages in Low Voltage AC Power Circuits (ANSI).
- B. IEEE C62.45: IEEE Guide for Surge Suppressor Testing (ANSI).

- C. NETA ATS: Acceptance Testing Specifications; Section 7.19, "Low-Voltage Surge Protection Devices".
- D. NEMA 250: Enclosures for Electrical Equipment (1000 Volts Maximum).
- E. NEMA WD 6: Wiring Device--Dimensional Requirements.
- F. NFPA 70: National Electrical Code.
- G. UL 486A: Wire Connectors and Soldering Lugs for Use with Copper Conductors.
- H. UL 1283: Electromagnetic Interference Filters.
- I. UL 1449 (3rd Edition Effective 9/29/2009): UL1149 4th Edition Effective 3/26/2016 Surge Protection Devices.

1.4 DEFINITIONS

- A. Inominal: Nominal discharge current.
- B. MCOV: Maximum continuous operating voltage.
- C. Mode(s), also Modes of Protection: The pair of electrical connections where the VPR applies.
- D. SCCR: Short-circuit current rating.
- E. SPD: Surge protective device.
- F. VPR: Voltage protection rating.

1.5 SUBMITTALS

- A. Product Data: For each type of product.
 - 1. Include rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories.
 - 2. Copy of UL Category Code VZCA certification, as a minimum, listing the tested values for VPRs, Inominal ratings, MCOVs, type designations, OCPD requirements, model numbers, system voltages, and modes of protection.
 - 3. Shipping, installed, and operating weights; furnished specialties; and accessories.
- B. Product Certificates: Signed by manufacturers of surge protection devices, certifying that products furnished comply with the following testing and labeling requirements:
 - 1. UL 1283 certification by an OSHA approved NRTL.
 - 2. UL 1449 (3rd Edition Effective 9/29/2009) 4th Edition Effective 3/26/2016 listing and classification by an OSHA approved NRTL.
 - 3. NEMA LS-1 Single Pulse

- C. Field Test Reports: Written reports of tests specified in Part 3 of this Section. Include the following:
 - 1. Test procedures used.
 - 2. Test results that comply with requirements.
 - 3. Failed test results and corrective action taken to achieve requirements.
- D. Maintenance Data: For surge protection devices to include in maintenance manuals specified in Division 1.
- E. Warranties: Special warranties specified in this Section.

1.6 INFORMATIONAL SUBMITTALS

- A. Field quality-control reports.
- B. Sample Warranty: For manufacturer's special warranty.

1.7 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For SPDs to include in maintenance manuals.

1.8 WARRANTY

- A. General Warranty: Special warranties specified in this Article shall not deprive Owner of other rights Owner may have under other provisions of the Contract Documents and shall be in addition to, and run concurrent with, other warranties made by Contractor under requirements of the Contract Documents.
- B. Special Warranty: Written warranty, executed by manufacturer agreeing to repair or replace components of surge suppressors that fail in materials or workmanship within specified warranty period.
 - 1. Warranty Period: Fifteen (15) years from date of Substantial Completion for TG and CGP series.

1.9 SERVICE CONDITIONS

- A. Rate surge protective devices for continuous operation under the following conditions, unless otherwise indicated:
 - 1. Maximum Continuous Operating Voltage: Not less than 115 percent of nominal system operating voltage.
 - 2. Operating Temperature: minus 20 degrees F to plus 120 degrees F.
 - 3. Humidity: 0 to 85 percent, non-condensing.

4. Altitude: Less than 20,000 feet above sea level.

PART 2 - PRODUCTS

2.1 GENERAL SPD REQUIREMENTS

- A. Manufacturers: Subject to compliance with requirements, provide products by the following:
 1. Current Technology Inc.
 2. Substitutions need to be submitted to Engineer for review a minimum of 10-days prior to bid date with a list of any deviations or exceptions from this specification.
- B. SPD with Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- C. Comply with NFPA 70.
- D. Comply with UL 1449. 4th Edition Effective 3/26/2016.
- E. MCOV of the SPD shall be the nominal system voltage.

2.2 PANEL SUPPRESSORS

- A. Comply with UL 1449 (4th Edition) Type 1, tested at Inominal Rating: 20 kA.
- B. Per ANSI/IEEE C62.41.1-2002, C62.41.2-2002 and C62.45-2002, the SPD system shall be repetitive surge current capacity tested in every mode using a 1.2 x 50 μ sec, 20KV open circuit voltage, 8 x 20 μ sec, 200KA short circuit current ANSI/IEEE C62.41 Category C3 waveform at one minute interval. Minimum repetitive strikes with less than 10% degradation of clamping voltage shall be 3500 repetitive C3 strikes per mode.
- C. Single Pulse Surge Testing: The maximum single-pulse surge current capacity per mode shall be verified through testing at an independent third party testing facility. Testing shall be conducted in each mode of the device and all tested modes shall be from the same test sample. This test shall include all components of the SPD system, including disconnects (if applicable) and fusing as a completed assembly. Individual component testing, module testing only, or subsystem testing of the SPD for compliance with this section will not be acceptable. Ratings based on the arithmetic sum of the ratings of the individual MOVs in a given mode are not acceptable. Testing that causes damage to the device, fuse operation, or voltage clamping performance degradation by more than 10% is not acceptable. The Single Pulse Surge Current Capacity shall be as below:
 1. 150kA per mode (Main Switchboard).
 2. 80kA per mode (Emergency Distribution Switchboards and Panels).
 3. 60kA per mode (Lighting Panels)

- D. Filtering: The SPD shall provide a noise filtering system capable of attenuating noise levels produced by electromagnetic interference and radio frequency interference (EMI/RFI). The system's filtering characteristics shall be expressed in decibels (dB) of attenuation at no less than 8 points over a frequency spectrum between 50kHz and 100MHz. The noise filtering system shall also be listed to UL 1283 by an approved NRTC, as an electromagnetic interference filter.
- E. Fusing: Each MOV shall be individually fused and designed to operate only in the event of an MOV failure within the SPD. In the event of an MOV failure, the fuse will operate to remove the failed MOV from the circuit. The remaining MOV's and fuses will stay intact to handle subsequent surges. The fusing included with the SPD system shall be required to meet the above requirement and shall be included with the above testing guidelines. Overcurrent fusing that limits the rated single pulse surge current of the SPD is not acceptable. Replaceable cartridge type per phase or per mode overcurrent fusing is not acceptable where there is more than one MOV per mode.
- F. Fault Current Capability: The unit shall be capable of interrupting up to a 200kA symmetrical fault current with 600VAC applied without the need of an upstream overcurrent protection device (fuse or circuit breaker).
- G. UL 1449 Voltage Protection Rating: The unit shall be UL 1449 3rd Edition 4th Edition Effective 3/26/2016 Listed by a Nationally Recognized Testing Laboratory and shall be as follows for L-N, L-G, N-G, and L-L, modes: Note: the below values are for a 120/240 or 120/208 volt systems, for 277/480 volts the VPR's are 1200V L-N, 1200V L-G, 1000V N-G, 2000V L-L
1. Main Distribution Panel: 150kA rated products (Current Technology TG3-150-480-3Y-MNB-M3-F-2):
 - a. Line to Neutral: 700 V.
 - b. Line to Ground: 700 V.
 - c. Neutral to Ground: 700 V.
 - d. Line to Line: 1200 V.
 2. Emergency Distribution Panel: 80kA rated products (Current Technology CGP-080-277/480-3GY):
 - a. Line to Neutral: 700 V.
 - b. Line to Ground: 700 V.
 - c. Neutral to Ground: 700 V.
 - d. Line to Line: 1200 V.
 3. Lighting Panels: 60kA rated products (Current Technology CGP-060-120/208-3GY):
 - a. Line to Neutral: 700 V.
 - b. Line to Ground: 700 V.
 - c. Neutral to Ground: 700 V.
 - d. Line to Line: 1200 V.

SPD units shall provide protection status indication via a tri-colored LED per phase. The tri-colored LED shall report when the SPD has reached 75% of remaining useful life, and 40% of remaining useful life.

- H. Monitoring Contacts: The unit shall come standard with Form C dry relay contacts (N.O. and N.C.) for remote monitoring capability, and internal audible alarm with silence button.
- I. Event Counter: The unit shall come standard with a transient event counter with LCD panel display and reset button on the front cover.
- J. Enclosure: The unit shall be supplied in a NEMA type 1 enclosure rated for indoor applications.

PART 3 - EXECUTION

3.1 COORDINATION

- A. Coordinate location of field-mounted surge suppressors to allow adequate clearances for maintenance.

3.2 INSTALLATION

- A. Placing into Service: Do not energize or connect service entrance equipment, or power or lighting panelboards to their sources until the surge protective devices are installed and connected. Verify system voltage prior to energizing surge protective device. When the cable connection length, between the SPD and the switchboard or panelboard, exceeds more than 6 lineal feet, the Contractor shall furnish and install a low impedance connection system from Current Technology, Model HPI, to maximize the performance of the SPD in mitigating the effects of transient voltage surges to the client's protected systems
- B. Comply with NECA 1.
- C. Install an OCPD or disconnect as required to comply with the UL listing of the SPD.
- D. Install SPDs with conductors between suppressor and points of attachment as short and straight as possible; adjust circuit-breaker positions to achieve shortest and straightest leads. Do not splice and extend SPD leads unless specifically permitted by manufacturer and Engineer. Do not exceed manufacturer's recommended lead length. Do not bond neutral and ground.
- E. Use crimped connectors and splices only. Wire nuts are unacceptable.
- F. Wiring:
 - 1. Power Wiring: Comply with wiring methods in Section 260519 "Low-Voltage Electrical Power Conductors and Cables."

3.3 CONNECTIONS

- A. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A.

3.4 FIELD QUALITY CONTROL AND START-UP

- A. Perform the following the following field quality-control tests and inspections with the assistance of a factory-authorized service representative.
 - 1. Compare equipment nameplate data for compliance with Drawings and Specifications.
 - 2. Inspect anchorage, alignment, grounding, and clearances.
 - 3. Verify that electrical wiring installation complies with manufacturer's written installation requirements.
 - 4. After installing surge protective devices, but before electrical circuitry has been energized, test for compliance with requirements, using a diagnostic portable test kit.
 - 5. Complete startup checks according to manufacturer's written instructions.
 - 6. Do not perform insulation-resistance tests of the distribution wiring equipment with SPDs installed. Disconnect SPDs before conducting insulation-resistance tests and reconnect them immediately after the testing is over.
 - 7. Energize SPDs after power system has been energized, stabilized, and tested.
- B. Manufacturer's Field Service: Upon completion of installation and prior to energization, a factory-authorized local service representative shall provide product start-up testing services. The tests shall include:
 - 1. On-Line Testing: Verification that all suppression and filtering paths are operating with 100% protection as well as verification of proper facility neutral-to-ground bond by measuring neutral-to-ground current and voltage.
 - 2. Off-line testing: Impulse injection to verify the system tolerances as well as verification of proper facility neutral-to-ground bond. To be compared to factory benchmark test parameters supplied with each individual unit.
- C. The SPD manufacturer's technician shall perform a system checkout and start-up in the field to assure proper installation, operation and to initiate the warranty of the system. The technician will be required to do the following:
 - 1. Verify voltage clamping levels utilizing a diagnostic test kit, comparing factory readings to installed readings.
 - 2. Verify N-G connection.
 - 3. Record information to a product signature card; to be located in each SPD for future evaluation.
- D. Documentation and Reporting:
 - 1. Prepare test and inspection reports.

- a. A copy of the start-up test results and the factory benchmark testing results shall be provided to the Engineer and the Owner for confirmation of proper system function.
 - b. This letter shall also confirm that all neutral-to-ground bonds were verified through testing and visual inspection, and that all grounding bonds were observed to be in place.
 - c. Include Operation and Maintenance Manual.
- E. An SPD will be considered defective if it does not pass tests and inspections. Repair or replace malfunctioning units. Retest after repairs or replacements are made.

3.5 DEMONSTRATION

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to operate and maintain surge protective devices.
 - 1. Train Owner's maintenance personnel on procedures and schedules for maintaining suppressors.
 - 2. Review data to be included in operation and maintenance manuals. Refer to Division 017823 "Operation and Maintenance Data."
 - 3. Schedule training with Owner, through Construction Manager, with a seven (7) day advanced notice.

END OF SECTION 264313

SECTION 271300 - COMMUNICATIONS BACKBONE CABLING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:
 - 1. Pathways.
 - 2. UTP cable.
 - 3. 50/125-micrometer, optical fiber cabling.
 - 4. Coaxial cable.
 - 5. Cable connecting hardware, patch panels, and cross-connects.
 - 6. Cabling identification products.
 - 7. Single mode fiber optic cabling.

1.3 DEFINITIONS

- A. BICSI: Building Industry Consulting Service International.
- B. Cross-Connect: A facility enabling the termination of cable elements and their interconnection or cross-connection.
- C. EMI: Electromagnetic interference.
- D. IDC: Insulation displacement connector.
- E. LAN: Local area network.
- F. RCDD: Registered Communications Distribution Designer.
- G. UTP: Unshielded twisted pair.

1.4 BACKBONE CABLING DESCRIPTION

- A. Backbone cabling system shall provide interconnections between communications equipment rooms, main terminal space, and entrance facilities in the telecommunications cabling system structure. Cabling system consists of backbone cables, intermediate and main cross-connects,

mechanical terminations, and patch cords or jumpers used for backbone-to-backbone cross-connection.

- B. Backbone cabling cross-connects may be located in communications equipment rooms or at entrance facilities. Bridged taps and splitters shall not be used as part of backbone cabling.

1.5 PERFORMANCE REQUIREMENTS

- A. General Performance: Backbone cabling system shall comply with transmission standards in TIA/EIA-568-B.1, when tested according to test procedures of this standard.

1.6 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated.
 - 1. For coaxial cable, include the following installation data for each type used:
 - a. Nominal OD.
 - b. Minimum bending radius.
 - c. Maximum pulling tension.
- B. Shop Drawings:
 - 1. System Labeling Schedules: Electronic copy of labeling schedules in Microsoft Excel software.
 - 2. Cabling administration drawings and printouts.
 - 3. Wiring diagrams to show typical wiring schematics including the following:
 - a. Cross-connects.
 - b. Patch panels.
 - c. Patch cords.
 - 4. Cross-connects and patch panels. Detail mounting assemblies, and show elevations and physical relationship between the installed components.

1.7 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For qualified layout technician, installation supervisor, and field inspector.
- B. Source quality-control reports.
- C. Field quality-control reports.
- D. Maintenance Data: For splices and connectors to include in maintenance manuals.

1.8 MAINTENANCE MATERIAL SUBMITTALS

- A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
 - 1. Patch-Panel Units: One of each type.
 - 2. Connecting Blocks: One of each type.

1.9 QUALITY ASSURANCE

- A. Installer Qualifications: Cabling Installer must have personnel certified by BICSI on staff.
 - 1. Layout Responsibility: Preparation of Shop Drawings, Cabling Administration Drawings, and field testing program development by an RCDD.
 - 2. Installation Supervision: Installation shall be under the direct supervision of Level 2 Installer, who shall be present at all times when Work of this Section is performed at Project site.
- B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- C. Telecommunications Pathways and Spaces: Comply with TIA/EIA-569-A.
- D. Grounding: Comply with ANSI-J-STD-607-A.

1.10 DELIVERY, STORAGE, AND HANDLING

- A. Test cables upon receipt at Project site.
 - 1. Test optical fiber cable to determine the continuity of the strand end to end. Use optical fiber flashlight or optical loss test set.
 - 2. Test optical fiber cable while on reels. Use an optical time domain reflectometer to verify the cable length and locate cable defects, splices, and connector, including the loss value of each. Retain test data and include the record in maintenance data.
 - 3. Test each pair of UTP cable for open and short circuits.

1.11 PROJECT CONDITIONS

- A. Environmental Limitations: Do not deliver or install cables and connecting materials until wet work in spaces is complete and dry, and temporary HVAC system is operating and maintaining ambient temperature and humidity conditions at occupancy levels during the remainder of the construction period.

1.12 COORDINATION

- A. Coordinate layout and installation of telecommunications pathways and cabling with Owner's telecommunications and LAN equipment and service suppliers.

PART 2 - PRODUCTS

2.1 PATHWAYS

- A. General Requirements: Comply with TIA/EIA-569-A.
- B. Cable Trays: Comply with requirements in Section 270536 Cable Trays for Communications Systems.
- C. Conduit and Boxes: Comply with requirements in Section 260533 "Raceway and Boxes for Electrical Systems."
 - 1. Outlet boxes shall be no smaller than 2-1/8 inches wide, 4 inches high, and 2-1/2 inches deep.

2.2 BACKBOARDS

- A. Backboards: Plywood, fire-retardant treated, 3/4 by 48 by 96 inches. Comply with requirements in Section 061000 "Rough Carpentry" for plywood backing panels.

2.3 UTP CABLE

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Hubbell Premise Wiring.
 - 2. 3M.
 - 3. AMP NETCONNECT; a TE Connectivity Ltd. company.
 - 4. Belden CDT Networking Division/NORDX.
 - 5. Berk-Tek Leviton; a Nexans/Leviton alliance.
 - 6. CommScope, Inc.
 - 7. Draka USA.
 - 8. General Cable; General Cable Corporation.
 - 9. Genesis Cable Products; Honeywell International, Inc.
 - 10. Mohawk; a division of Belden Networking, Inc.
 - 11. Superior Essex Inc.
 - 12. SYSTIMAX Solutions; a CommScope Inc. brand.
- B. Description: 100-ohm, four-pair UTP, formed into 25-pair, binder groups covered with a blue thermoplastic jacket.

1. Comply with ICEA S-90-661 for mechanical properties.
2. Comply with TIA/EIA-568-B.1 for performance specifications.
3. Comply with TIA/EIA-568-B.2, Category 6.
4. Listed and labeled by an NRTL acceptable to authorities having jurisdiction as complying with UL 444 and NFPA 70 for the following types:
 - a. Communications, General Purpose: Type CM or CMG.
 - b. Communications, Plenum Rated: Type CMP, complying with NFPA 262.
 - c. Communications, Riser Rated: Type CMR, complying with UL 1666.
 - d. Communications, Limited Purpose: Type CMX.
 - e. Multipurpose: Type MP or MPG.
 - f. Multipurpose, Plenum Rated: Type MPP, complying with NFPA 262.
 - g. Multipurpose, Riser Rated: Type MPR, complying with UL 1666.

2.4 UTP CABLE HARDWARE

- A. Manufacturers: Subject to compliance with requirements, provide products by the following:
 1. Leviton Manufacturing Co., Inc.
- B. General Requirements for Cable Connecting Hardware: Comply with TIA/EIA-568-B.2, IDC type, with modules designed for punch-down caps or tools. Cables shall be terminated with connecting hardware of same category or higher.
- C. Connecting Blocks: 110-style IDC for Category 6. Provide blocks for the number of cables terminated on the block, plus 25 percent spare. Integral with connector bodies, including plugs and jacks where indicated.
- D. Jacks and Jack Assemblies: Modular, color-coded, eight-position modular receptacle units with integral IDC-type terminals.
- E. Patch Cords: Factory-made, four-pair cables in 48-inch lengths; terminated with eight-position modular plug at each end.
 1. Patch cords shall have bend-relief-compliant boots and color-coded icons to ensure Category 6 performance. Patch cords shall have latch guards to protect against snagging.

2.5 OPTICAL FIBER CABLE

- 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. 3M.
 2. AMP NETCONNECT; a TE Connectivity Ltd. company.
 3. Belden CDT Networking Division/NORDX.
 4. Berk-Tek Leviton; a Nexans/Leviton alliance.

5. CommScope, Inc.
6. Corning Cable Systems.
7. CSI Technologies Inc.
8. General Cable; General Cable Corporation.
9. Mohawk; a division of Belden Networking, Inc.
10. Superior Essex Inc.
11. SYSTIMAX Solutions; a CommScope Inc. brand.

- B. Description: Multimode, 50/125-micrometer, 24-fiber, nonconductive, tight buffer, optical fiber cable.

1. Comply with ICEA S-83-596 for mechanical properties.
2. Comply with TIA/EIA-568-B.3 for performance specifications.
3. Comply with TIA-492AAAB for detailed specifications.
4. Listed and labeled by an NRTL acceptable to authorities having jurisdiction as complying with UL 444, UL 1651, and NFPA 70 for the following types:
 - a. General Purpose, Nonconductive: Type OFN or OFNG.
 - b. Plenum Rated, Nonconductive: Type OFNP, complying with NFPA 262.
 - c. Riser Rated, Nonconductive: Type OFNR, complying with UL 1666.
 - d. General Purpose, Conductive: Type OFC or OFCG.
 - e. Plenum Rated, Conductive: Type OFCP, complying with NFPA 262.
 - f. Riser Rated, Conductive: Type OFCR, complying with UL 1666.
5. Maximum Attenuation: 3.50 dB/km at 850 nm; 1.5 dB/km at 1300 nm.
6. Minimum Modal Bandwidth: 160 MHz-km at 850 nm; 500 MHz-km at 1300 nm.

- C. Jacket:

1. Jacket Color: Aqua for 50/125-micrometer cable.
2. Cable cordage jacket, fiber, unit, and group color shall be according to TIA-598-C.
3. Imprinted with fiber count, fiber type, and aggregate length at regular intervals not to exceed 40 inches.

- D. Description: Single mode, 12-strand, plenum rated, OS2, tight-buffered, non-armored.

1. Use between Main Distribution Frame (MDF) and each Intermediate Distribution Frame (IDF).

2.6 OPTICAL FIBER CABLE HARDWARE

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

1. Leviton Manufacturing Co., Inc.

- B. Cross-Connects and Patch Panels: Modular panels housing multiple-numbered, duplex cable connectors.

1. Number of Connectors per Field: One for each fiber of cable or cables assigned to field, plus spares and blank positions adequate to suit specified expansion criteria.
- C. Patch Cords: Factory-made, dual-fiber cables in 36-inch lengths.
- D. Cable Connecting Hardware:
 1. Comply with Optical Fiber Connector Intermateability Standards (FOCIS) specifications of TIA-604-2-B, TIA-604-3-B, and TIA/EIA-604-12. Comply with TIA/EIA-568-B.3.
 2. Quick-connect, simplex and duplex, Type SC or Type LC connectors. Insertion loss not more than 0.75 dB.
 3. Type SFF connectors may be used in termination racks, panels, and equipment packages.

2.7 COAXIAL CABLE

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 1. Alpha Wire.
 2. Belden CDT Networking Division/NORDX.
 3. Coleman Cable, Inc.
 4. CommScope, Inc.
 5. Draka USA.
- B. Cable Characteristics: Broadband type, recommended by cable manufacturer specifically for broadband data transmission applications. Coaxial cable and accessories shall have 75-ohm nominal impedance with a return loss of 20 dB maximum from 7 to 806 MHz.
- C. RG-11/U: NFPA 70, Type CATV.
 1. No. 14 AWG, solid, copper-covered steel conductor.
 2. Gas-injected, foam-PE insulation.
 3. Double shielded with 100 percent aluminum polyester tape and 60 percent aluminum braid.
 4. Jacketed with sunlight-resistant, black PVC or PE.
 5. Suitable for outdoor installations in ambient temperatures ranging from minus 40 to plus 85 deg C.
- D. RG59/U: NFPA 70, Type CATVR.
 1. No. 20 AWG, solid, silver-plated, copper-covered steel conductor.
 2. Gas-injected, foam-PE insulation.
 3. Triple shielded with 100 percent aluminum polyester tape and 95 percent aluminum braid; covered by aluminum foil with grounding strip.
 4. Color-coded PVC jacket.
- E. RG-6/U: NFPA 70, Type CATV or CM.

1. No. 16 AWG, solid, copper-covered steel conductor; gas-injected, foam-PE insulation.
2. Double shielded with 100 percent aluminum-foil shield and 60 percent aluminum braid.
3. Jacketed with black PVC or PE.
4. Suitable for indoor installations.

F. RG59/U: NFPA 70, Type CATV.

1. No. 20 AWG, solid, copper-covered steel conductor; gas-injected, foam-PE insulation.
2. Double shielded with 100 percent aluminum polyester tape and 40 percent aluminum braid.
3. PVC jacket.

G. RG59/U (Plenum Rated): NFPA 70, Type CMP.

1. No. 20 AWG, solid, copper-covered steel conductor; foam fluorinated ethylene propylene insulation.
2. Double shielded with 100 percent aluminum-foil shield and 65 percent aluminum braid.
3. Copolymer jacket.

H. NFPA and UL compliance, listed and labeled by an NRTL acceptable to authorities having jurisdiction as complying with UL 1655 and with NFPA 70 "Radio and Television Equipment" and "Community Antenna Television and Radio Distribution" Articles. Types are as follows:

1. CATV Cable: Type CATV.
2. CATV Plenum Rated: Type CATVP, complying with NFPA 262.
3. CATV Riser Rated: Type CATVR, complying with UL 1666.
4. CATV Limited Rating: Type CATVX.

2.8 GROUNDING

- A. Comply with requirements in Section 270526 "Grounding and Bonding for Communications Systems" for grounding conductors and connectors.
- B. Comply with ANSI-J-STD-607-A.

2.9 IDENTIFICATION PRODUCTS

- A. Comply with TIA/EIA-606-A and UL 969 for a system of labeling materials, including label stocks, laminating adhesives, and inks used by label printers.

2.10 SOURCE QUALITY CONTROL

- A. Factory test cables on reels according to TIA/EIA-568-B.1.
- B. Factory test UTP cables according to TIA/EIA-568-B.2.

- C. Factory test multimode optical fiber cables according to TIA/EIA-526-14-A and TIA/EIA-568-B.3.
- D. Cable will be considered defective if it does not pass tests and inspections.
- E. Prepare test and inspection reports.

PART 3 - EXECUTION

3.1 ENTRANCE FACILITIES

- A. Coordinate backbone cabling with the protectors and demarcation point provided by communications service provider.

3.2 WIRING METHODS

- A. Wiring Method: Install cables in raceways and cable trays except within consoles, cabinets, desks, and counters. Conceal raceway and cables except in unfinished spaces.
 - 1. Install plenum cable in environmental air spaces, including plenum ceilings.
 - 2. Comply with requirements for raceways and boxes specified in Section 260533 "Raceway and Boxes for Electrical Systems."
- B. Wiring within Enclosures: Bundle, lace, and train cables within enclosures. Connect to terminal points with no excess and without exceeding manufacturer's limitations on bending radii. Provide and use lacing bars and distribution spools.

3.3 INSTALLATION OF PATHWAYS

- A. Cable Trays: Comply with NEMA VE 2 and TIA/EIA-569-A.
- B. Comply with requirements for demarcation point, pathways, cabinets, and racks specified in Section 271100 "Communications Equipment Room Fittings." Drawings indicate general arrangement of pathways and fittings.
- C. Comply with TIA/EIA-569-A for pull-box sizing and length of conduit and number of bends between pull points.
- D. Comply with requirements in Section 260533 "Raceway and Boxes for Electrical Systems" for installation of conduits and wireways.
- E. Install manufactured conduit sweeps and long-radius elbows whenever possible.
- F. Pathway Installation in Communications Equipment Rooms:

1. Position conduit ends adjacent to a corner on backboard where a single piece of plywood is installed, or in the corner of room where multiple sheets of plywood are installed around perimeter walls of room.
 2. Install cable trays to route cables if conduits cannot be located in these positions.
 3. Secure conduits to backboard when entering room from overhead.
 4. Extend conduits 3 inches above finished floor.
 5. Install metal conduits with grounding bushings and connect with grounding conductor to grounding system.
- G. Backboards: Install backboards with 96-inch dimension vertical. Butt adjacent sheets tightly, and form smooth gap-free corners and joints.

3.4 INSTALLATION OF CABLES

- A. Comply with NECA 1.
- B. General Requirements for Cabling:
1. Comply with TIA/EIA-568-B.1.
 2. Comply with BICSI ITSIM, Ch. 6, "Cable Termination Practices."
 3. Install 110-style IDC termination hardware unless otherwise indicated.
 4. Terminate all conductors; no cable shall contain unterminated elements. Make terminations only at indicated outlets, terminals, cross-connects, and patch panels.
 5. Cables may not be spliced. Secure and support cables at intervals not exceeding 30 inches and not more than 6 inches from cabinets, boxes, fittings, outlets, racks, frames, and terminals.
 6. Install lacing bars to restrain cables, to prevent straining connections, and to prevent bending cables to smaller radii than minimums recommended by manufacturer.
 7. Bundle, lace, and train conductors to terminal points without exceeding manufacturer's limitations on bending radii, but not less than radii specified in BICSI ITSIM, "Cabling Termination Practices" Chapter. Use lacing bars and distribution spools.
 8. Do not install bruised, kinked, scored, deformed, or abraded cable. Do not splice cable between termination, tap, or junction points. Remove and discard cable if damaged during installation and replace it with new cable.
 9. Cold-Weather Installation: Bring cable to room temperature before dereeling. Heat lamps shall not be used for heating.
 10. In the communications equipment room, install a 10-foot-long service loop on each end of cable.
 11. Pulling Cable: Comply with BICSI ITSIM, Ch. 4, "Pulling Cable." Monitor cable pull tensions.
- C. UTP Cable Installation:
1. Comply with TIA/EIA-568-B.2.
 2. Do not untwist UTP cables more than 1/2 inch from the point of termination to maintain cable geometry.
- D. Optical Fiber Cable Installation:

1. Comply with TIA/EIA-568-B.3.
 2. Cable may be terminated on connecting hardware that is rack or cabinet mounted.
- E. Open-Cable Installation:
1. Install cabling with horizontal and vertical cable guides in telecommunications spaces with terminating hardware and interconnection equipment.
 2. Suspend UTP cable not in a wireway or pathway, a minimum of 8 inches above ceilings by cable supports not more than 60 inches apart.
 3. Cable shall not be run through structural members or in contact with pipes, ducts, or other potentially damaging items.
- F. Installation of Cable Routed Exposed under Raised Floors:
1. Install plenum-rated cable only.
 2. Install cabling after the flooring system has been installed in raised floor areas.
 3. Coil cable 6 feet long not less than 12 inches in diameter below each feed point.
- G. Outdoor Coaxial Cable Installation:
1. Install outdoor connections in enclosures complying with NEMA 250, Type 4X. Install corrosion-resistant connectors with properly designed O-rings to keep out moisture.
 2. Attach antenna lead-in cable to support structure at intervals not exceeding 36 inches.
- H. Group connecting hardware for cables into separate logical fields.
- I. Separation from EMI Sources:
1. Comply with BICSI TDMM and TIA/EIA-569-A recommendations for separating unshielded copper voice and data communication cable from potential EMI sources, including electrical power lines and equipment.
 2. Separation between open communications cables or cables in nonmetallic raceways and unshielded power conductors and electrical equipment shall be as follows:
 - a. Electrical Equipment Rating Less Than 2 kVA: A minimum of 5 inches.
 - b. Electrical Equipment Rating between 2 and 5 kVA: A minimum of 12 inches.
 - c. Electrical Equipment Rating More Than 5 kVA: A minimum of 24 inches.
 3. Separation between communications cables in grounded metallic raceways and unshielded power lines or electrical equipment shall be as follows:
 - a. Electrical Equipment Rating Less Than 2 kVA: A minimum of 2-1/2 inches.
 - b. Electrical Equipment Rating between 2 and 5 kVA: A minimum of 6 inches.
 - c. Electrical Equipment Rating More Than 5 kVA: A minimum of 12 inches.
 4. Separation between communications cables in grounded metallic raceways and power lines and electrical equipment located in grounded metallic conduits or enclosures shall be as follows:

- a. Electrical Equipment Rating Less Than 2 kVA: No requirement.
 - b. Electrical Equipment Rating between 2 and 5 kVA: A minimum of 3 inches.
 - c. Electrical Equipment Rating More Than 5 kVA: A minimum of 6 inches.
5. Separation between Communications Cables and Electrical Motors and Transformers, 5 kVA or HP and Larger: A minimum of 48 inches.
 6. Separation between Communications Cables and Fluorescent Fixtures: A minimum of 5 inches.

3.5 FIRESTOPPING

- A. Comply with requirements in Section 078413 "Penetration Firestopping."
- B. Comply with TIA/EIA-569-A, Annex A, "Firestopping."
- C. Comply with BICSI TDMM, "Firestopping Systems" Article.

3.6 GROUNDING

- A. Install grounding according to BICSI TDMM, "Grounding, Bonding, and Electrical Protection" Chapter.
- B. Comply with ANSI-J-STD-607-A.
- C. Locate grounding bus bar to minimize the length of bonding conductors. Fasten to wall allowing at least 2-inch clearance behind the grounding bus bar. Connect grounding bus bar with a minimum No. 4 AWG grounding electrode conductor from grounding bus bar to suitable electrical building ground.
- D. Bond metallic equipment to the grounding bus bar, using not smaller than No. 6 AWG equipment grounding conductor.

3.7 IDENTIFICATION

- A. Identify system components, wiring, and cabling complying with TIA/EIA-606-A. Comply with requirements for identification specified in Section 260553 "Identification for Electrical Systems."
 1. Administration Class: 2.
 2. Color-code cross-connect fields and apply colors to voice and data service backboards, connections, covers, and labels.
- B. Comply with requirements in Section 099123 "Interior Painting" for painting backboards. For fire-resistant plywood, do not paint over manufacturer's label.
- C. Paint and label colors for equipment identification shall comply with TIA/EIA-606-A for Class 2 level of administration including optional identification requirements of this standard.

- D. Comply with requirements in Section 271500 "Communications Horizontal Cabling" for cable and asset management software.
- E. Cable Schedule: Install in a prominent location in each equipment room and wiring closet. List incoming and outgoing cables and their designations, origins, and destinations. Protect with rigid frame and clear plastic cover. Furnish an electronic copy of final comprehensive schedules for Project.
- F. Cabling Administration Drawings: Show building floor plans with cabling administration-point labeling. Identify labeling convention and show labels for telecommunications closets, backbone pathways and cables, entrance pathways and cables, terminal hardware and positions, horizontal cables, work areas and workstation terminal positions, grounding buses and pathways, and equipment grounding conductors.
- G. Cable and Wire Identification:
 - 1. Label each cable within 4 inches of each termination and tap, where it is accessible in a cabinet or junction or outlet box, and elsewhere as indicated.
 - 2. Each wire connected to building-mounted devices is not required to be numbered at device if color of wire is consistent with associated wire connected and numbered within panel or cabinet.
 - 3. Exposed Cables and Cables in Cable Trays and Wire Troughs: Label each cable at intervals not exceeding 15 feet.
 - 4. Label each terminal strip and screw terminal in each cabinet, rack, or panel.
 - a. Individually number wiring conductors connected to terminal strips and identify each cable or wiring group being extended from a panel or cabinet to a building-mounted device with name and number of particular device as shown.
 - b. Label each unit and field within distribution racks and frames.
 - 5. Identification within Connector Fields in Equipment Rooms and Wiring Closets: Label each connector and each discrete unit of cable-terminating and connecting hardware. Where similar jacks and plugs are used for both voice and data communication cabling, use a different color for jacks and plugs of each service.
- H. Labels shall be preprinted or computer-printed type with printing area and font color that contrasts with cable jacket color but still complies with requirements in TIA/EIA 606-A, for the following:
 - 1. Cables use flexible vinyl or polyester that flexes as cables are bent.

3.8 FIELD QUALITY CONTROL

- A. Perform tests and inspections.
- B. Tests and Inspections:

1. Visually inspect UTP and optical fiber jacket materials for NRTL certification markings. Inspect cabling terminations in communications equipment rooms for compliance with color-coding for pin assignments, and inspect cabling connections for compliance with TIA/EIA-568-B.1.
2. Visually inspect cable placement, cable termination, grounding and bonding, equipment and patch cords, and labeling of all components.
3. Test UTP copper cabling for DC loop resistance, shorts, opens, intermittent faults, and polarity between conductors. Test operation of shorting bars in connection blocks. Test cables after termination but not cross-connection.
 - a. Test instruments shall meet or exceed applicable requirements in TIA/EIA-568-B.2. Perform tests with a tester that complies with performance requirements in "Test Instruments (Normative)" Annex, complying with measurement accuracy specified in "Measurement Accuracy (Informative)" Annex. Use only test cords and adapters that are qualified by test equipment manufacturer for channel or link test configuration.
4. Optical Fiber Cable Tests:
 - a. Test instruments shall meet or exceed applicable requirements in TIA/EIA-568-B.1. Use only test cords and adapters that are qualified by test equipment manufacturer for channel or link test configuration.
 - b. Link End-to-End Attenuation Tests:
 - 1) Horizontal and multimode backbone link measurements: Test at 850 or 1300 nm in 1 direction according to TIA/EIA-526-14-A, Method B, One Reference Jumper.
 - 2) Attenuation test results for backbone links shall be less than 2.0 dB. Attenuation test results shall be less than that calculated according to equation in TIA/EIA-568-B.1.
- C. Data for each measurement shall be documented. Data for submittals shall be printed in a summary report that is formatted similar to Table 10.1 in BICSI TDMM, or transferred from the instrument to the computer, saved as text files, and printed and submitted.
- D. Remove and replace cabling where test results indicate that they do not comply with specified requirements.
- E. End-to-end cabling will be considered defective if it does not pass tests and inspections.
- F. Prepare test and inspection reports.

END OF SECTION 271300

SECTION 284621.11 - ADDRESSABLE FIRE-ALARM SYSTEMS

PART 1 - GENERAL

1.1 OVERVIEW

- A. The fire alarm system is an addressable system. The VESDA system is extremely sensitive smoke detection system intended for use in locations as indicated on Electrical Construction Sheets. The VESDA system indicated has been selected for use in the inmate occupied pod cells and dayrooms; benefits of VESDA detection, in lieu of photoelectric smoke detectors, at these locations include:
- a. Very early smoke detection of inmate normally occupied areas.
 - b. It minimizes disruptions to these large inmate housing areas for ongoing maintenance/testing/servicing and for code required periodic testing and certification of detectors using a code required smoke test.
 - 1) The VESDA system allows for smoke tests to be performed remote from the VESDA smoke heads located in these inmate-occupied pod cells and dayrooms. This reduces logistical, security, and coordination efforts otherwise required by the Owner to facilitate a service technician with periodic testing and certification in the pods.
 - 2) These pods, which house large numbers of inmates, cannot be easily shifted to other building spaces during smoke tests. Smoke testing in these spaces could be expected to extend over a 2 to 3-day period; further exasperating the planning and logistical efforts required by the Owner to facilitate smoke testing directly at smoke heads.
 - c. The VESDA smoke heads are a passive device and are less susceptible to costly vandalism within inmate occupied pod cells and dayrooms. In comparison, use of photoelectric smoke detectors in these areas requires a vandal-guard and more susceptibility to costly vandalism.

1.2 SUBSTITUTE REQUESTS

- A. A substitute request, where approved by the Owner, Engineer, and AHJ, could be considered for use of VESDA detection in areas other than as indicated on Electrical Construction Sheets (i.e. - in lieu of the photoelectric smoke or heat detectors). Locations that may be considered may include:
- 1. Non-normally occupied inmate cells such as in Booking and Medical; i.e. where potential for vandalism would be more-costly to maintain the fire alarm detection system.
 - 2. Areas where a higher smoke hazard could exist (i.e. Laundry) and very early detection would better-protect life, limb, or property.

- B. Under no circumstance, during the bidding period, will a substitute request be initiated, considered, evaluated, or approved during the bid period. It would be the Contractor's responsibility to present and coordinate all necessary modifications and engineering efforts for such a substitute request.

1.3 RELATED DOCUMENTS

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

1.4 SUMMARY

- A. Section Includes:

1. Fire-alarm control unit.
2. Pre-action system.
3. Manual fire-alarm boxes.
4. System smoke detectors.
5. System Heat detectors.
6. Notification appliances.
7. Firefighters' smoke-control system.
8. Interactive Firefighter's Display.
9. Graphic annunciator workstation.
10. System printer.
11. Non-powered graphic annunciator panel.
12. Addressable interface device.
13. Network communications.
14. Remote fire alarm annunciators.
15. Remote status and alarm indicators
16. Addressable interface device.
17. Digital Telco Alarm Communicator Transmitter.
18. Digital Cellular Radio Alarm Communicator Transmitter.
19. Device guards.
20. Fire Alarm Cabling
21. VESDA Air-sampling smoke detectors.

- B. Related Requirements:

1. Section 017823 "Operation and Maintenance Data."
2. Section 230993.11 "Sequence of Operations for HVAC DDC" for Firefighters' Smoke Control System and sequence of operation.
3. Section 260548.16 "Seismic Controls for Electrical Systems."

1.5 DEFINITIONS

- A. EMT: Electrical Metallic Tubing.
- B. BMS: Building Management System.
- C. FACP: Fire Alarm Control Panel.
- D. HLI: High Level Interface.
- E. LED: Light Emitting Diode.
- F. LCD: Liquid Crystal Display.
- G. NAC: Notification Appliance Circuit.
- H. NICET: National Institute for Certification in Engineering Technologies.
- I. PC: Personal computer.
- J. VESDA: Very Early Smoke-Detection Apparatus.

1.6 ACTION SUBMITTALS

- A. Product Data: For each type of product, including furnished options and accessories.
 - 1. Include construction details, material descriptions, dimensions, profiles, and finishes.
 - 2. Include rated capacities, operating characteristics, and electrical characteristics.
- B. Shop Drawings: For fire-alarm system.
 - 1. Comply with recommendations and requirements in the "Documentation" section of the "Fundamentals" chapter in NFPA 72.
 - 2. Include plans, elevations, sections, details, and attachments to other work.
 - 3. Include details of equipment assemblies. Indicate dimensions, weights, loads, required clearances, method of field assembly, components, and locations. Indicate conductor sizes, indicate termination locations and requirements, and distinguish between factory and field wiring.
 - 4. Include network diagrams, field wiring diagrams, and detailed equipment wiring and termination diagrams.
 - 5. Detail assembly and support requirements.
 - 6. Include voltage drop calculations for notification-appliance circuits.
 - 7. Include battery-size calculations.
 - 8. Include input/output matrix.
 - 9. 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.
 - 10. Include performance parameters and installation details for each detector.

11. Verify that each duct detector is listed for complete range of air velocity, temperature, and humidity possible when air-handling system is operating.
12. Provide program report showing that air-sampling detector pipe layout balances pneumatically within the airflow range of the air-sampling detector.
13. 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 and equipment required for HVAC unit shutdown on alarm and override by Firefighters' Smoke Control Station.
 - c. Locate detectors according to manufacturer's written recommendations.
 - d. Show air-sampling detector pipe routing.

C. General Submittal Requirements:

1. Submittals shall be approved by Authorities Having Jurisdiction prior to submitting them to Engineer.
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.

D. Delegated-Design Submittal: For notification appliances and smoke and heat detectors, in addition to submittals listed above, indicate compliance with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1. Drawings showing the location of each notification appliance and smoke and heat detector, ratings of each, and installation details as needed to comply with listing conditions of the device.
2. Design Calculations: Calculate requirements for selecting the spacing and sensitivity of detection, complying with NFPA 72. Calculate spacing and intensities for strobe signals and sound-pressure levels for audible appliances.
3. Indicate audible appliances required to produce square wave signal per NFPA 72.

1.7 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer.

B. Seismic Qualification Data: Certificates, for fire-alarm control unit, accessories, and components, from manufacturer.

1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.
2. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.

3. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.
 - C. Field quality-control reports.
- 1.8 Sample Warranty: For special warranty.
- 1.9 CLOSEOUT SUBMITTALS
- A. Operation and Maintenance Data: For fire-alarm systems and components to include in emergency, operation, and maintenance manuals.
 1. In addition to items specified in Section 017823 "Operation and Maintenance Data," include the following and deliver copies to Authorities Having Jurisdiction:
 - a. Comply with the "Records" section of the "Inspection, Testing and Maintenance" chapter in NFPA 72.
 - b. Provide "Fire Alarm and Emergency Communications System Record of Completion Documents" according to the "Completion Documents" Article in the "Documentation" section of the "Fundamentals" chapter in NFPA 72.
 - c. Complete wiring diagrams showing connections between all devices and equipment. Each conductor shall be numbered at every junction point with indication of origination and termination points.
 - d. Riser diagram.
 - e. Device addresses.
 - f. Air-sampling system sample port locations and modeling program report showing layout meets performance criteria.
 - g. Record copy of site-specific software.
 - h. 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.
 - i. Manufacturer's required maintenance related to system warranty requirements.
 - j. 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.

1.10 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Lamps for Remote Indicating Lamp Units: Quantity equal to 10 percent of amount installed, but no fewer than one unit.
2. Lamps for Strobe Units: Quantity equal to 10 percent of amount installed, but no fewer than one unit.
3. Smoke Detectors, Fire Detectors: Quantity equal to 10 percent of amount of each type installed, but no fewer than one unit of each type.
4. Detector Bases: Quantity equal to two percent of amount of each type installed, but no fewer than one unit of each type.
5. Keys and Tools: One extra set for access to locked or tamper-proofed components.
6. Audible and Visual Notification Appliances: One of each type installed.
7. Fuses: Two of each type installed in the system. Provide in a box or cabinet with compartments marked with fuse types and sizes.
8. Filters for VESDA Air-Sampling Detectors: Quantity equal to two percent of amount of each type installed, but no fewer than one unit of each type.
9. VESDA Air-Sampling Fan: Quantity equal to one (1) for every five (5) VESDA detectors, but no fewer than one (1) unit of each type.

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

1.12 PROJECT CONDITIONS

- A. Perform a full test of the existing system prior to starting work. Document any equipment or components not functioning as designed.

- B. Use of Devices during Construction: Protect devices during construction unless devices are placed in service to protect the facility during construction.

1.13 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 (5) 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, the same system. Provide system manufacturer's certification that all components provided have been tested as, and will operate as, a system.
- B. Non-coded, 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 and systems:
 - 1. Manual stations.
 - 2. Heat detectors.
 - 3. Smoke detectors.
 - 4. Duct smoke detectors.
 - 5. Air-sampling smoke-detection system (VESDA).
 - 6. Automatic sprinkler system water flow.
 - 7. Pre-action system.
 - 8. Fire-extinguishing system operation.
 - 9. ANSUL
 - 10. VESDA Air-Sampling Detectors

- 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, connected network control panels, off-premises network control panels, and remote annunciators.
 3. Transmit an alarm signal to the remote alarm receiving station.
 4. Switch heating, ventilating, and air-conditioning equipment controls to fire-alarm mode.
 5. Activate smoke-control system (smoke management) at Firefighters' Smoke Control Station.
 6. Close smoke dampers in air ducts of designated air-conditioning duct systems.
 7. Activate pre-action system.
 8. Activate emergency shutoffs for gas and fuel supplies.
 9. Record events in the system memory.
 10. Record events by the system printer.
 11. Indicate device in alarm on the graphic annunciator.
- 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 pre-action sprinkler system.
 3. Alert and Action signals of air-sampling detector system.
 4. Independent fire-detection and -suppression systems.
 5. User disabling of zones or individual devices.
 6. 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, remote annunciator, printer interface, or Ethernet module.
 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, connected network control panels, and remote annunciators.
 3. Record the event on system printer.
 4. After a time delay of 200 seconds, transmit a trouble or supervisory signal to the remote alarm receiving station.
 5. Transmit system status to building management system.
 6. Display system status on graphic annunciator.

2.3 PERFORMANCE REQUIREMENTS

- A. Seismic Performance: Fire-alarm control unit and raceways shall withstand the effects of earthquake motions determined according to the minimum requirements in ASCE 7-10 Chapter 13.
 - 1. The term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified and the unit will be fully operational after the seismic event."
 - 2. Seismic Requirements for Nonstructural Components:
 - a. Site Class: D.
 - b. Building Risk Category: III.
 - c. Seismic Design Category: C.
 - d. Component Importance Factor: 1.5.
 - e. Amplification Factors and Component Response Modification Factors: As required in ASCE 7-10 Table 13.6-1 (Mechanical and Electrical) for components and raceways and supports.

2.4 MANUFACTURERS (FIRE ALARM CONTROL UNITS, DEVICES, AND APPURTENANCES)

- A. Manufacturer (Basis-of-Design): Owner has pre-approved the following manufacturer's system as the Basis-of-Design:
 - 1. Gamewell, Security and Fire; a division of Honeywell.
 - 2. This Owner pre-approved manufacturer shall be bid separately as an Alternate; refer to front end specifications for Alternate numbering and description.
 - a. Pricing for this manufacturer's system shall be listed separately in the Contractor's bid tab.
 - 1) Bid tab shall break out pricing for this manufacturer's system separate from manufacturers; systems listed below.
 - 2) Pricing for this manufacturer's system, shall be reviewed by the Owner and Engineer to determine if this Alternate is accepted in lieu of manufacturers' systems listed below which are submitted for approval as a performance equal and which are submitted for approval for pricing.

- B. Manufacturers (Equals): Subject to compliance with requirements, products by one of the following manufacturers may be considered as an equal to the Basis-of-Design manufacturer listed above:
1. Edwards; UTC Climate, Controls & Security; a division of United Technologies Corporation.
 2. Siemens Industry, Inc.; Fire Safety Division.
 3. SimplexGrinnell LP.
 4. Either of these manufacturers' systems, if elected by Contractor for consideration for approval by Owner and Engineer, shall be 1) A performance equal to the Basis-of-Design manufacturer's system listed above and 2) Pricing shall be broken out separately by Contractor in the Bid Tab; separate from pricing for the Basis-of-Design manufacturer's system listed above.
- C. Manufacturer shall have a minimum of three (3) independent factory authorized and trained service dealers/technicians, available within a fifty (50) mile radius of the installation, for ongoing and price competitive servicing of the installed system. Submit a listing of all qualified independent dealers/technicians within this radius capable of supporting the installed system.

2.5 FIRE-ALARM CONTROL UNIT (MAIN FIRE ALARM CONTROL PANEL FACP-1)

- A. General Requirements for Fire-Alarm Control Unit:
1. Field-programmable, microprocessor-based, modular, power-limited design with electronic modules, complying with UL 864.
 - a. System software and programs shall be held in nonvolatile flash, electrically erasable, programmable, read-only memory, retaining the information through failure of primary and secondary power supplies.
 - b. Include a real-time clock for time annotation of events on the event recorder and printer.
 - c. Provide communication between the FACP and remote circuit interface panels, annunciators, and displays.
 - d. The FACP shall be listed for connection to a central-station signaling system service.
 - e. Provide nonvolatile memory for system database, logic, and operating system and event history. The system shall require no manual input to initialize in the event of a complete power down condition. The FACP shall provide a minimum 500-event history log.
 2. Addressable Initiation Device Circuits: The FACP shall indicate which communication zones have been silenced.
 3. Addressable Control Circuits for Operation of Notification Appliances and Mechanical Equipment: The FACP shall be listed for releasing service.

- B. 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, three line(s) of 80 characters, minimum.
 - 2. Keypad: Arranged to permit entry and execution of programming, display, and control commands and to indicate control commands to be entered into the system for control of smoke-detector sensitivity and other parameters.
- C. Fire Alarm Control Unit to NAC Unit Communication:
 - 1. Pathway Class Designations: NFPA 72, Class A, redundant pathway.
 - 2. Pathway Survivability: Level 1.
- D. Fire Alarm Control Unit to BMS Unit Communication:
 - 1. Pathway Class Designations: NFPA 72, Class A, redundant pathway.
 - 2. Pathway Survivability: Level 1.
- E. Network Communication:
 - 1. Pathway Class Designations: NFPA 72, Class C.
 - 2. Pathway Survivability: Level 1.
- F. Initiating-Device, Notification-Appliance, and Signaling-Line Circuits:
 - 1. Pathway Class Designations: NFPA 72, Class E.
 - 2. Pathway Survivability: Level 1.
 - 3. Install no more than 50 addressable devices on each signaling-line circuit.
- G. Serial Interfaces:
 - 1. One dedicated RS 485 port for central-station operation using point ID DACT.
 - 2. One dedicated RS 485 port for each of the following:
 - a. Remote fire alarm annunciators (standard annunciators).
 - b. Remote fire alarm annunciator (Interactive Fire Fighters' Display).
 - c. Multi-interface module (printer port).
 - 3. One USB port for PC configuration.
- H. Gateway Interface to VESDA system
 - 1. One RS 232 port for VESDA HLI communication interface (or gateway interface as required by VESDA).
- I. Gateway Interface to Building Management System
 - 1. BACnet port for BACnet communication interface to Building Management System.

- J. Ethernet IP Gateways to “The Cloud”
 - 1. Ethernet port for Ethernet IP Interface to “The Cloud” via VPN to Owner’s Intranet network.
 - a. Used for connection to “The Cloud” for manufacturer’s software solutions, manufacturer test and inspection, and manufacturer’s system manager app.
- K. Smoke-Alarm Verification (Smoke detectors, Air-sampling smoke-detection system [VESDA]):
 - 1. Initiate audible and visible indication of an "alarm-verification" signal at fire-alarm control unit.
 - 2. Activate an approved "alarm-verification" sequence at fire-alarm control unit and detector.
 - 3. Record events by the system printer.
 - 4. Sound general alarm if the alarm is verified.
 - 5. Cancel fire-alarm control unit indication and system reset if the alarm is not verified.
- L. Smoke-Alarm Verification (Duct smoke detectors): Not required.
- M. 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.
- N. Door hold-open devices: Not applicable this project.
- O. 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 and print out the final adjusted values on system printer.
- P. Transmission to Remote Alarm Receiving Station: Automatically transmit alarm, supervisory, and trouble signals to a remote alarm receiving station.
- Q. Printout of Events: On receipt of signal, print alarm, supervisory, and trouble events. Identify zone, device, and function. Include type of signal (alarm, supervisory, or trouble) and date and time of occurrence. Differentiate alarm signals from all other printed indications. Also, print system reset event, including same information for device, location, date, and time. Commands initiate the printing of a list of existing alarm, supervisory, and trouble conditions in the system and a historical log of events.

- R. 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 signals, supervisory and digital telco alarm communicator transmitters, and digital cellular radio alarm communicator transmitter 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.
- S. Secondary Power: 24-V dc supply system with batteries, automatic battery charger, and automatic transfer switch.
 - 1. Batteries: Sealed lead calcium.
- T. Instructions: Computer printout or typewritten instruction card mounted behind a plastic or glass cover in a stainless-steel or aluminum frame. Include interpretation and describe appropriate response for displays and signals. Briefly describe the functional operation of the system under normal, alarm, and trouble conditions.

2.6 PRE-ACTION SYSTEM

- A. Initiate Pre-signal Alarm: This function shall cause an audible and visual alarm and indication to be provided at the FACP. Activation of an initiation device connected as part of a pre-action system shall be annunciated at the FACP only, without activation of the general evacuation alarm.

2.7 MANUAL FIRE-ALARM BOXES

- A. General Requirements for Manual Fire-Alarm Boxes: Comply with UL 38. Boxes shall be finished in red with molded, raised-letter operating instructions in contrasting color; shall show visible indication of operation; and shall be mounted on recessed outlet box. If indicated as surface mounted, provide manufacturer's surface back box.
 - 1. Double-action mechanism requiring two actions to initiate an alarm, 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.
 - 3. Indoor, Detention Grade, Protective Shield (For inmate occupied areas as designated by an asterisk ('*') on the Electrical Construction Sheets): Factory-fabricated, clear plastic enclosure hinged at the top to permit lifting for access to initiate an alarm. Lifting the cover actuates an integral battery-powered audible horn intended to discourage false-alarm operation.

2.8 SYSTEM SMOKE DETECTORS

A. General Requirements for System Smoke Detectors:

1. Comply with UL 268; operating at 24-V dc, nominal.
2. Detectors shall be two (2) 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. Multiple levels of detection sensitivity for each sensor.
 - b. Sensitivity levels based on time of day.

B. Photoelectric Smoke Detectors:

1. Detector address shall be accessible from fire-alarm control unit and shall be able to identify the detector's location within the system and its sensitivity setting.
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.).

C. Duct Smoke Detectors: Photoelectric type complying with UL 268A.

1. Two (2) wire.
2. 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.
3. 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.).

4. Weatherproof Duct Housing Enclosure: NEMA 250, Type 4X; NRTL listed for use with the supplied detector for smoke detection in HVAC system ducts.
5. Each sensor shall have multiple levels of detection sensitivity.
6. Sampling Tubes: Design and dimensions as recommended by manufacturer for specific duct size, air velocity, and installation conditions where applied.
7. Relay Fan Shutdown: Fully programmable relay rated to interrupt fan motor-control circuit.

D. Remote Test Station for Duct Smoke Detectors

1. Locations as indicated on Electrical Construction Sheets – i.e. Centrally located adjacent to Firefighters' Smoke Control Station.
2. Multi-colored LED Status Light: Light alternates between steady green (normal) and red (alarm).
3. Keyed test station. Provide minimum of two (2) spare keys.
4. Four (4) wire.

2.9 SYSTEM HEAT DETECTORS

- A. Heat detector locations are as indicated on Electrical Construction Sheets. As part of the delegated design submittal, select rate of rise and fixed temperature based on performance requirements that are most appropriate for the area/location (i.e. to minimize detection response time for a flame or fire event).
- B. Two (2) wire.
- C. General Requirements for Heat Detectors: Comply with UL 521.
 1. Temperature sensors shall test for and communicate the sensitivity range of the device.
- D. Heat Detector, Combination Type: Actuated by either a fixed temperature of 135 deg F (or as otherwise required by the delegated design) or a rate of rise that exceeds 15 deg F per minute (or as otherwise determined by the delegated design).
 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.

2.10 NOTIFICATION APPLIANCES

- A. Non-addressable Notification Appliances shall be acceptable. Non-addressable notification appliances shall be connected to notification-appliance signal circuits and zoned as indicated on Electrical Construction Sheets. Appliances shall be 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.
- B. Horns: Electric-vibrating-polarized type, 24-V dc; with provision for housing the operating mechanism behind a grille. Comply with UL 464. Horns shall produce a sound-pressure level of 90 dBA, measured 10 feet from the horn, using the coded signal prescribed in UL 464 test protocol.
- C. Visible Notification Appliances: Xenon strobe lights complying with UL 1971, with clear or nominal white polycarbonate lens mounted on an aluminum faceplate. The word "FIRE" is engraved in minimum 1-inch-high letters on the lens.
 - 1. Rated Light Output:
 - a. 15/30/75/110 cd, selectable in the field.
 - 2. Mounting: Wall mounted unless otherwise indicated.
 - 3. For units with guards to prevent physical damage, light output ratings shall be determined with guards in place.
 - 4. Flashing shall be in a temporal pattern, synchronized with other units.
 - 5. Strobe Leads: Factory connected to screw terminals.
 - 6. Mounting Faceplate: Factory finished, red.
- D. Master Sync: All visual notification devices throughout the building shall be synchronized strobes. Provide a master sync circuit at the fire alarm control panel and connect to the sync input of each NAC power supply.

2.11 FIREFIGHTERS' SMOKE-CONTROL SYSTEM

- A. Smoke Control System, equipment, and components shall be supplied by HVAC/Mechanical Contractor. System and components shall comply with UL 864.
- B. Fire alarm system shall communicate with the Building Management System (BMS) Panel via BACnet protocol or as otherwise required by the BMS Vendor.
 - 1. The Fire Alarm Control Panel(s) shall be provided with a BACnet interface card. The fire alarm system Vendor shall coordinate with and provide to the BMS Vendor the address registers/descriptions at the Fire Alarm Control Panel(s) necessary for operation of the Smoke Control System.

2. The FACP Vendor shall demonstrate operation of the fire alarm/detection system in conjunction with demonstration of the Smoke Control System by the BMS Vendor. Demonstration shall be provided in the presence of the Owner, Engineer, and Authorities Having Jurisdiction.

C. Initiate Smoke-Management Sequence of Operation:

1. Comply with sequence of operation as described on Mechanical Construction Documents.
2. Fire-alarm system shall provide all interfaces and control points required to properly activate smoke-management systems.
3. First fire-alarm system initiating device to go into alarm condition shall activate the smoke-control functions.
4. Subsequent devices going into alarm condition shall have no effect on the smoke-control mode.

D. Addressable Relay Modules:

1. Provide address-setting means on the module. Store an internal identifying code for control panel use to identify the module type.
2. Allow the control panel to switch the relay contacts on command.
3. Have a minimum of two normally open and two normally closed contacts available for field wiring.
4. Listed for controlling HVAC fan motor controllers.

E. Comply with UL 864.

2.12 INTERACTIVE FIREFIGHTERS' DISPLAY

- A. The remote annunciator panel in the Master Control Room shall be an interactive firefighters' display.
- B. Features: 22" LCD Touch-Screen; recess mount or semi-recess mount.
- C. The touch screen display will provide firefighters information about the building including:
 1. A layout of building floor plans with room names and numbers.
 2. Detailed site-specific information including:
 - a. Location of all supervised fire alarm devices.
 - b. Water supplies.
 - c. Evacuation routes.
 - d. Access Routes.
 - e. Chemical and structural hazards in the building.
 - f. Shutoffs for gas, power, and HVAC.

3. Status/Indication of Smoke Control equipment shall not be indicated at this display. Refer to Mechanical Specifications for requirements for status/indication/control at the Firefighters' Smoke Control Station.

2.13 GRAPHIC ANNUNCIATOR WORKSTATION

- A. Provide a Graphic Annunciator Workstation for the fire alarm/detection system and the VESDA system. Workstation shall be located in the Facility Manager's Office as indicated on the Electrical Construction Sheets. Workstation shall include the following:
 1. Workstation Software: PC-based, fire-alarm annunciator software with historical logging, report generation, and a graphic interface showing all alarm points in the system.
 - a. Provide support software such as:
 - 1) System manager app.
 - a) Webserver for remote monitoring/troubleshooting/testing for remote users via system manager app.
 - 2) Software for push notifications (text, email, etc.) to remote users.
 - b. VESDA software (i.e. Xtralis VSM) monitoring VESDAnet networking with annunciate alarms and faults through High Level Interface (HLI), shall reside on the PC.
 - c. Firmware upgrades.
 2. Workstation Equipment: Provide PC with operating system software, hard drive with minimum storage as recommended by Vendor, two (2) large digital display monitors, wireless keyboard, wireless mouse, and other PC accessories for a complete and operable system. PC shall have minimum storage and processing power for Owner installed software such as MS Office. PC shall be configured with communication card for Ethernet IP Connection, PC network card for RS232 or RS485 connection to Fire Alarm Control Panel, RS232 to printer connection, and other network cards and communication ports as necessary or required by the Owner.

2.14 SYSTEM PRINTER

- A. Printer shall be located at the Graphic Annunciator Workstation in the Facility Manager's Office as indicated on the Electrical Construction sheets.
- B. Printer shall be listed and labeled as an integral part of fire-alarm system.

2.15 NON-POWER GRAPHIC ANNUNCIATOR PANEL

- A. A non-powered/non-illuminated Graphic Annunciator Panel shall be located within Facility Office C1055 and mounted above the Fire Alarm Graphic Workstation as indicated on Electrical Construction Sheets. Graphic Annunciator Panel shall be used for the display of the building floor plan(s), room names/numbers, and fire alarm device types and locations.
- B. Graphic Annunciator Panel: Mounted in an aluminum frame with nonglare, minimum 3/16-inch-thick, clear acrylic cover over graphic representation of the facility. Detector locations shall be represented by red LED lamps. Normal system operation shall be indicated by a lighted, green LED. Trouble and supervisory alarms shall be represented by an amber LED.
 - 1. Surface mounted in a NEMA 250, Type 1 cabinet, with key lock and no exposed screws or hinges.
 - 2. Graphic representation of the facility shall be a CAD drawing and each detector shall be represented in its actual location. CAD drawing shall be at 1/8-inch per foot scale or as otherwise required by Engineer to fit within the allotted wall space within the room and above the remote fire alarm annunciator panel.

2.16 NETWORK COMMUNICATIONS

- A. Provide network communications for fire-alarm system according to fire-alarm manufacturer's written requirements.
- B. Provide network communications pathway per manufacturer's written requirements and requirements in NFPA 72 and NFPA 70.
- C. Provide integration gateway using BACnet for connection to the Building Management System (BMS).

2.17 REMOTE FIRE ALARM ANNUNCIATORS

- 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 mount cabinet, NEMA 250, Type 1. Surface mount may be used where indicated on Construction Sheets and approved by Engineer.
- 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.

2.18 REMOTE STATUS AND ALARM INDICATORS

- A. Description: Provide remote status and indicators with visual indication of an alarm on a concealed addressable detector.
- B. 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.

2.19 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 equipment requiring shutdown or other functionality.
 - 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.

2.20 DIGITAL TELCO ALARM COMMUNICATOR TRANSMITTER

- A. A primary (Telco) Digital alarm communicator transmitter (DACT) shall be used as the primary transmission device. DACT shall be acceptable to the remote central station receiver 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 two (s) POTS (Plain Old Telephone system) 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.
 - 4. Manual test report function and manual transmission clear indication.
 - 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.
 - 8. Communication bus failure.
- E. Power shall be provided from the fire alarm control panel battery/battery charger system.
- F. Self-Test: Conducted automatically every 24 hours with report transmitted to remote central station receiver.

2.21 DIGITAL CELLULAR RADIO ALARM COMMUNICATOR TRANSMITTER

- A. A secondary (backup) alarm transmitter shall be provided for the fire alarm system. DACT shall be acceptable to the remote central station receiver and shall comply with UL 632.
- B. Transmitter shall comply with:
 - 1. NFPA 1221
 - 2. 47 CFR 90
 - 3. UL 864
 - 4. UL 985
- C. Description: Manufacturer's standard commercial product; factory assembled, wired, and tested; ready for installation and operation.
 - 1. Packaging: A single, modular, NEMA 250, Type 1 metal enclosure with a tamper-resistant flush tumbler lock.
 - 2. Signal Transmission Mode and Frequency: Cellular frequency coordinated with operating characteristics of the established remote alarm receiving station designated by Owner.
 - 3. Normal Power Input: 120-V ac.
 - 4. Secondary Power: Integral-sealed, rechargeable, 12-V battery and regulated battery charger. Comply with NFPA 72 requirements for battery capacity; submit calculations.

5. Antenna: Provide directional or omnidirectional antenna. Where a remote, outdoor antenna is necessary, provide wind-load strength of antenna and mounting hardware and supports shall withstand 100 mph with a gust factor of 1.3 without failure.
 6. Antenna Cable: Coaxial cable with impedance matched to the transmitter output impedance.
 7. Antenna-Cable Connectors: Weatherproof.
 8. Alarm Interface Devices: Circuit boards, modules, and other auxiliary devices, integral to the transmitter, matching fire-alarm and other system outputs to message-generating inputs of the transmitter that produce required message transmissions.
- D. Functional Performance: Unit shall receive alarm, supervisory, or trouble signal from fire-alarm control unit or from its own internal sensors or controls and shall automatically transmit signal along with a unique code that identifies the transmitting station to the remote alarm receiving station. Transmitted messages shall correspond to standard designations for fire-reporting system to which the signal is being transmitted and shall include separately designated messages in response to the following events or conditions:
1. Transmitter Low-Battery Condition: Sent when battery voltage is below 85 percent of rated value.
 2. System Test Message: Initiated manually by a test switch within the transmitter cabinet, or automatically at an optionally preselected time, once every 24 hours, with transmission time controlled by a programmed timing device integral to transmitter controls.
 3. Transmitter Trouble Message: Actuated by failure, in excess of one-minute duration, of the transmitter normal power source, derangement of the wiring of the transmitter, or any alarm input interface circuit or device connected to it.
 4. Local Fire-Alarm-System Trouble Message: Initiated by events or conditions that cause a trouble signal to be indicated on the building system.
 5. Local Fire-Alarm-System Alarm Message: Actuated when the building system goes into an alarm state. Identifies device that initiated the alarm.
 6. Local Fire-Alarm-System, Supervisory-Alarm Message: Actuated when the building alarm system indicates a supervisory alarm.

2.22 DEVICE GUARDS

- A. Devices with detention rated guards are designated with an asterisk (‘*’) on Electrical Construction Sheets.
- B. Description: Welded wire mesh of size and shape for the manual station, smoke detector, gong, or other device requiring protection.
 1. Factory fabricated and furnished by device manufacturer.
 2. Finish: Paint of color to match the protected device.
- C. For visible notification units with guards to prevent physical damage, light output ratings shall be determined with guards in place.

- D. Guard for smoke detector shall be perforated and shall be UL tested and approved for use with the smoke detector. Refer to perforated smoke detector guard detail on Electrical Construction Detail Sheets.

2.23 FIRE ALARM CABLING

A. Performance Requirements

- 1. Surface-Burning Characteristics: Comply with ASTM E 84; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
 - a. Flame-Spread Index: 25 or less.
 - b. Smoke-Developed Index: 50 or less.
- 2. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. UTP cabling.

C. Description: 100-ohm, four-pair UTP, covered with a blue thermoplastic jacket.

- 1. Comply with ICEA S-90-661 for mechanical properties.
- 2. Comply with TIA/EIA-568-B.1 for performance specifications.
- 3. Comply with TIA/EIA-568-B.2, Category 6.
- 4. Listed and labeled by an NRTL acceptable to authorities having jurisdiction as complying with UL 444 and NFPA 70 for the following types:
 - a. Communications, Plenum Rated: Type CMP, complying with NFPA 262.
 - b. Communications, Riser Rated: Type CMR, complying with UL 1666.

D. RS-232 cabling.

- 1. Plenum-Rated Cable: NFPA 70, Type CMP.
 - a. Paired, 2 pairs, No. 22 AWG, stranded (7x30) tinned copper conductors.
 - b. Plastic insulation.
 - c. Individual aluminum foil-polyester tape shielded pairs with 100 percent shield coverage.
 - d. Plastic jacket.
 - e. Pairs are cabled on common axis with No. 24 AWG, stranded (7x32) tinned copper drain wire.
 - f. Flame Resistance: Comply with NFPA 262.

E. RS-485 cabling.

1. Plenum-Rated Cable: NFPA 70, Type CMP.
 - a. Paired, 2 pairs, No. 22 AWG, stranded (7x30) tinned copper conductors.
 - b. Fluorinated ethylene propylene insulation.
 - c. Unshielded.
 - d. Fluorinated ethylene propylene jacket.
 - e. Flame Resistance: NFPA 262, Flame Test.

F. Low-voltage control cabling.

1. Plenum-Rated, Paired Cable: NFPA 70, Type CMP.
 - a. One pair, twisted, No. 16 AWG, stranded tinned copper conductors.
 - b. PVC insulation.
 - c. Unshielded.
 - d. PVC jacket.
2. Flame Resistance: Comply with NFPA 262

G. Control-circuit conductors.

1. Class 1 Control Circuits: Stranded copper, [Type THHN-THWN, complying with UL 83, in raceway].
2. Class 2 Control Circuits: Stranded copper, [Type THHN-THWN, complying with UL 83, in raceway].
3. Class 3 Remote-Control and Signal Circuits: Stranded copper, Type TW or TF, complying with UL 83.

H. Fire alarm wire and cable.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Comtran Corporation.
 - b. Draka Cableteq USA.
 - c. Genesis Cable Products; Honeywell International, Inc.
 - d. Rockbestos-Suprenant Cable Corp.
 - e. West Penn Wire.
2. General Wire and Cable Requirements: NRTL listed and labeled as complying with NFPA 70, Article 760.
3. Signaling Line Circuits: Twisted, shielded pair, not less than No. 18 AWG and/or size as recommended by fire alarm system manufacturer.
4. Circuit Integrity Cable: Twisted shielded pair, NFPA 70, Article 760, Classification CI, for power-limited fire alarm signal service Type FPL. NRTL listed and labeled as complying with UL 1424 and UL 2196 for a 2-hour rating.

5. Non-Power-Limited Circuits: Solid-copper conductors with 600-V rated, 75 deg C, color-coded insulation.
 - a. Line-Voltage Circuits: No. 12 AWG minimum.

2.24 VESDA AIR-SAMPLING SMOKE DETECTION (ASD) SYSTEM

A. General Description:

1. This VESDA system shall be installed in locations as indicated on Electrical Construction Sheets. This system is a point addressable, early warning fire detection system.
2. Air-sampling smoke detector shall be laser based using a piping system and a fan to transport the particles of combustion to the detector.
3. Provide two levels of alarm from each zone covered by the detector and two supervisory levels of alarm from each detector.
4. The air being sampled shall pass through filters to remove dust particulates greater than 20 microns before entering the detection chamber.
5. Detectors shall have the capability via RS 485 to connect up to 100 detectors in a network.
6. Detectors shall communicate with the fire-alarm control unit via addressable, monitored dry contact closures, RS 485, and interface modules. Provide a minimum of six relays, individually programmable remotely for any function.

B. Manufacturers: The manufacturer shall have a minimum of 35 years production experience in the design and manufacture of high sensitivity air sampling smoke detection systems. The manufacturer shall be certified as meeting ISO 9001:2008 for manufacturing. Subject to compliance with requirements, provide products by the following:

1. Xtralis; a division of Honeywell.
2. No approved performance equal.

C. Manufacturer shall have a minimum of three (3) independent factory authorized and trained service dealers/technicians, available within a fifty (50) mile radius of the installation, for ongoing and price competitive servicing of the installed system. Submit a listing of all qualified independent dealers/technicians within this radius capable of supporting the installed system.

D. Submittals -Submit the following for approval by Engineer:

1. Product Data
2. Shop drawings: Include equipment layout, wiring diagrams, labeling of devices and equipment, bills of material, mounting accessories/boxes/details, pipe layout, operational calculations and performance criteria.
 - a. Pipe airflow balancing calculations shall be performed using approved calculation software. Design software tools such as ASPIRE may be used to generate this material.

3. Supplier Qualifications: The equipment supplier shall be authorized and trained by the manufacturer to calculate/design, install, test and maintain the ASD system based on code requirements. The equipment supplier shall submit a certificate of training from the manufacturer.
 4. Installer Qualifications: The equipment installer shall be authorized and trained by the manufacturer and shall have the ability to install and test the ASD system. The installer shall submit a certificate of training from the manufacturer. The installation and programming of the ASD shall be completed by a factory-trained installer.
 5. Calculations, design, and testing documents for review and approval by Engineer and Authorities Having Jurisdiction.
 6. Operation and maintenance manuals.
- E. Air Sampling Smoke Detectors [Monitoring/Alarming Panels] (Manufacturer: Xtralis; Model: VESDA-E VEA; Part Number: VEA-040-A10)
1. All tubing for each sample point shall be the same length based on its longest run and shall have a minimum of 100 feet as required by manufacturer's recommendation.
 2. General Description:
 - a. 40-point-addressable smoke detection points.
 - 1) Each detector shall not exceed a maximum of 40 sample points and shall not have less than 10 sample points per detector.
 - b. Highly sensitive LASER-based smoke sensor module with replaceable filter.
 - c. High capacity pump and a rotary valve connected to a network of individual microbore tubes with individual sampling points on microbore tubes.
 - d. Modular
 - e. LED and LCD User Interface:
 - f. Optional relay module to annunciate individual alarms for the sampling points connected to the microbore tubes.
 - g. VESDAnet networking to annunciate alarms and faults through High Level Interface (HLI) and / or on monitoring software such as VSM.
 3. System Features:
 - a. Approved to provide Early Warning Fire Detection (EWFD) / Class A / Class B and Standard Fire Detection (SFD) / Class C.
 - b. Tested and approved to cover up to a 36,000 sq. ft. area subject to system design and local regulatory requirements.
 - c. Consists of a highly sensitive LASER-based light scattering smoke sensor module, filter, rotary valve, pump, microbore tubes and sampling points.
 - d. Consists of an air sampling microbore tube network with each tube having individual sampling point at the end to transport air to the detection system.
 - e. Supports forty (40) point-addressable detection points with two individual smoke detection chambers each supporting 20 detection points.

- f. Provide one (1) test port for each of the two (2) detection chambers to facilitate centralized and periodic code required smoke testing under user control of the forty (40) detection points.
- 4. General Requirements:
 - a. Housing: Smoke Sensor Module, Filter, Pump, Rotary valve and Relay Outputs shall be housed in a metal enclosure and shall be arranged in such a way that air is drawn from the fire risk area by the pump and a sample is passed through a sample filter and the smoke sensor module.
 - b. The detector shall have 40 microbore sampling tube inlets and must employ a flow measurement arrangement to detect individual flow per tube.
 - c. Light Source: The Detection Chamber shall employ a highly sensitive LASER light source and a photodiode.
 - d. Detection Method: The detection sensing method shall use a laser light source and at least one photodiode spaced inside the detection chamber to detect smoke particles. Smoke detection shall include:
 - 1) Minimizing the effect of large dust particles on the true smoke obscuration.
 - 2) Settable filter life based on the environment with notification when filter maintenance is required.
 - e. Absolute Calibration: The detection chamber shall be factory calibrated and shall not use adaptive algorithms or drift compensation techniques to adjust the sensitivity or detector output from that established during commissioning.
 - f. Filters: Disposable filter cartridge shall be capable of filtering particles in-excess-of 20 microns from the air sample. A second filter shall be ultrafine, removing more than 99% of contaminant particles of 0.3microns or larger, to provide a clean air barrier around the detector's optics to prevent contamination and increased service life.
 - 1) The filter shall be accessible by opening the cover to the field wiring terminal area. Once accessible, the filter shall be removable and replaceable using a readily available tool.
 - g. Pump: The pump shall be capable of allowing for multiple microbore sampling tube runs up to 328 feet each with a transport time per applicable local codes.
 - h. Settable filter life based on the environment with notification when filter maintenance is required.
 - i. The detector shall have ability to perform leak test by isolating the external microbore tube network to ensure integrity of internal detection air path.
 - j. The detector shall employ modular construction allowing field replacement of the filter, smoke sensor module, rotary valve and the pump.

- k. Provide:
 - 1) Detection of sampling point and microbore tube blockage.
 - 2) Detection of microbore tube breakage and sampling point presence at set intervals.
 - 3) Cleaning of sampling point at set intervals
- 5. LED User Interface:
 - a. Include display module within each detector.
 - b. Each display shall provide the following features at a minimum:
 - 1) A bar-graph display.
 - 2) Four independent, high-intensity alarm indicators (ALERT, ACTION, FIRE-1, and FIRE-2), corresponding to the four alarm thresholds of the indicated sector.
 - 3) Four (4) LED alarm threshold indicators to indicate ALERT, ACTION, FIRE-1 and FIRE-2 alarm events; one TROUBLE LED;
 - 4) LED indication that the first alarm sector is established.
 - 5) Detector fault and airflow fault indicators.
 - 6) LED indicators shall be provided for faults originating in the particular zone (Zone Fault), faults produced by the overall smoke-detection system, and faults resulting from network wiring errors (Network Fault). Minor and urgent LED fault indicators.
 - 7) Provide each of the 40-point addressable smoke detection points provided with a separate indicator LED.
 - 8) Provide LED user interface with a button to support RESET and DISABLE commands; one DISABLE/STANDBY LED; and POWER ON/POWER OFF indication. All LEDs shall have appropriate symbols without any text.
- 6. LCD User Interface
 - a. Provide an LCD user interface option showing detector status for each of the 40-point addressable smoke detection points; including fault categories and smoke level relative to the fire alarm setting. Provide with the following characteristics:
 - 1) Color LCD touch screen user interface with bar graph display.
 - 2) Alarm threshold indicators for Alert, Action and Fire 1.
 - 3) Fault icons indicating faults for these categories: detector, chamber, filter, flow, aspirator, network, power and external module where applicable.
 - 4) A touch screen interface to allow scrolling through status screens on the LCD.
- 7. Monitoring and Alarming:
 - a. Supports five (5) addressable high-level-interface (HLI) alarms (i.e. general trouble, clean filter, tube blockage, and other field assignable as necessary).

- b. Provide individual sampling point tube alarm (FIRE-1), identifying the fire location through addressable sampling point detection point by scanning the rotary valve, once global detector level fire alarm (FIRE-1) alarm is initiated.
- c. Supports global detector level fire alarms during a smoke event with:
 - 1) One (1) addressable output level identifying the fire location through addressable detection sampling points by scanning through the rotary valve.
 - 2) Provide four (4) addressable output level alarm thresholds for the global detector alarm corresponding to ALERT, ACTION, FIRE-1, and FIRE-2.
 - a) Alarm Level 1 (ALERT): Activate a visual and an audible supervisory alarm. ALERT threshold set to a % of Fire-1 threshold
 - b) Alarm Level 2 (ACTION): Activate shutdown of electrical/HVAC equipment and activate a visual and an audible supervisory alarm. ACTION threshold set in the middle of ALERT and FIRE-1 thresholds
 - c) Alarm Level 3 (FIRE-1): Activate building alarm systems and initiate call to fire response unit. Global alarm FIRE-1 level shall be selectable from three options corresponding to sampling point sensitivity of High = 1.6% obs/m (0.5% obs/ft), Enhanced = 4% obs/m (1.3% obs/ft), and Standard = 8% obs/m (2.5% obs/ft).
 - d) Alarm Level 4 (FIRE-2): Activate suppression system or other countermeasures. Global alarm FIRE-2 alarm automatically set to two (2) times (2x) the global alarm (FIRE-1) setting.
 - e) The detector shall have two (2) adjustable pre-alarm smoke alarm thresholds:
 - f) Air-Sampling Flow Rates Outside Manufacturer's Specified Range: Result in a trouble alarm.
 - g) Provide software-programmable relays rated at 2 A at 30-V dc for alarm and fault conditions.
- d. Supports High Level Interface (HLI) equipment for communication with the Main Fire Alarm Control Panel.
- e. Detector shall also transmit the following faults:
 - 1) DETECTOR
 - 2) AIR FLOW
 - 3) FILTER
 - 4) SYSTEM
 - 5) ZONE
 - 6) NETWORK
 - 7) POWER
 - 8) CHAMBER
 - 9) MODULE

- f. Urgent and Minor Faults. Minor faults shall be designated as trouble alarms. Urgent faults, which indicate the unit may not be able to detect smoke, shall be designated as supervisory alarms
 - g. The detector shall support the generation and transmission of urgent and minor faults. Minor faults shall be considered as servicing or maintenance signals. Urgent faults indicate the unit may not be able to detect smoke.
 - h. The detector shall contain seven (7) or more relays for alarm and fault conditions. The relays shall be software programmable to the required functions. The relays shall be rated at 2 Amp at 30 VDC. Additional local relays shall be offered as an option to provide an alarm relay output for each of the microbore sampling tube representing a sampling point.
 - i. The detector shall have built-in event and smoke logging. It shall store smoke levels, alarm conditions, operator actions and faults. The date and time of each event shall be recorded. Each detector (zone) shall allow storage of up to 20,000 events and does not require the presence of a display in order to do so.
 - j. The detector shall incorporate a galvanically isolated General-Purpose-Input (GPI) which activates in the event of an applied voltage of 5 to 50VDC and can be assigned by configuration to activate one of several functions (Reset, Disable, Reset/Disable, Stand-by, Mains OK, Day/Night).
 - k. The detector shall incorporate a monitored voltage-free input, to be used with isolated relay contacts, which is supervised using a 10k Ohm terminating resistor.
8. Communication:
- a. Report any fault on the detector by using configurable fault relay outputs.
 - b. Report any fault on the detector by using configurable fault relay outputs and/or via a peer-to-peer communications network. The Peer-to-Peer Communications Networking: A peer-to-peer networking facility shall be provided for the purposes of reporting alarms, faults and monitoring status, history and for configuration of devices. The peer-to-peer network shall:
 - 1) Comprise a physical layer that shall:
 - a) Comply with the ANSI/TIA/EIA-485-A-1998 electrical specifications.
 - b) Employ asynchronous serial data transfer.
 - c) Operate at a baud rate no less than 19.2 kBaud.
 - d) Detect communications errors due to interference, open and short circuit.
 - e) Detect ground faults.
 - 2) Support up to 200 devices (detectors, displays and programmers) of which 100 detectors can be supported.
 - 3) Be configurable in a fault tolerant loop for short circuit, open circuit and ground fault. Any communication faults shall be reported unambiguously and shall be clearly attributable to an individual device or wire link in the fault messages.
 - 4) Be configurable by PC based configuration tools that are available to configure and manage the network of detectors.

- c. Secondary Communications
 - 1) Detectors shall provide inbuilt secondary communications for monitoring and configuration using the following physical media:
 - a) USB.
 - b) 10/100 BaseT Ethernet.
 - c) WiFi (IEEE 802.11b/g).
 - d. Provide PC connection port at unit for laptop for programming, maintenance, service, and support.
- 9. Remote Monitoring from Remote PC Work Station
 - a. The VESDA system shall be integrated into the Fire Alarm/Detection System for monitoring of the overall building fire alarm/detection system.
 - 1) Software: The VESDA system shall have available PC-hardware-based software to monitor all VESDA devices connected to a Peer-to-Peer VESDA system via High Level Interfaces.
 - 2) Dedicated PC-based monitoring workstation.
 - a) Software for the Peer-to-Peer VESDA system shall be available to monitor all VESDA devices connected to the VESDA system; however, the software from the Fire Alarm/Detection Panel Manufacturer shall be utilized at this dedicated workstation for this project.
 - b) Work Station shall be located in the Facility Manager's Office as indicated on Electrical Construction Sheets.
 - b. VESDA Software Configuration and Programming
 - 1) Configuration and programming may be performed using a Windows application such as Xtralis VSC running on a PC connected through a High-Level-Interfacing unit (PC-Link HLI) or by direct connection to a detector or through Ethernet network.
 - 2) Configuration and programming tool shall support the following features at a minimum:
 - a) Programming of any device on the VESDAnet system as per the device documentation.
 - b) Viewing of the status of any device in the system.
 - c) Adjustment of the alarm thresholds of a nominated detector.
 - d) Setting of Day/Night, weekend and holiday sensitivity threshold settings.
 - e) Multi-level password control.
 - f) Programmable latching or non-latching relay operation.
 - g) Programmable energized or de-energized relays.

- h) Programmable high and low flow settings for airflow supervision.
- i) Number of microbore tubes in use and input maximum length of a microbore tube.
- j) Programming if sampling points are used on a VEA detector.
- k) Programmable maintenance intervals.
- l) Facilities for referencing with time dilution compensation.
- m) Testing of relays assigned to a specific zone to aid commissioning.

c. Security for WiFi Access

- 1) The following security measures shall be provided for secondary communications utilizing WiFi for a VESDA Peer-to-Peer system:
 - a) Connectivity via wireless access shall support WPA2 encryption with encryption key.
 - b) Access to a detector via Ethernet or WiFi shall be protected using a detector password specific to the detector and in addition to the WiFi encryption key.
 - c) All software connecting to a detector or peripheral shall support an authentication protocol to verify that it has been supplied by the manufacturer of the system.

d. Software Upgrades

- 1) There shall be provision for field upgrading the firmware in the system using a USB memory key connected directly to the detector, avoiding the need for a separate PC for this function.

F. Smoke detection sampling points (Non-Tamper Resistant)

- 1. Color: White
- 2. Mounting: Flush or surface mount as required.
- 3. The sampling points shall comply with the following requirements:
 - a. Sampling points shall not be separated by more than the maximum distance allowed for conventional point detectors as specified in the local codes and standards. Intervals may vary according to calculations. For AS1670.1-2004 the maximum allowable distance is 10.2m. For FIA the maximum allowable distance is 10.6m. For NFPA the maximum allowable distance is 30ft.
 - b. Each sampling point shall be identified in accordance with Codes or Standards.
 - c. Sample point shall have a built-in mechanism to enable sampling point testing and microbore tube integrity testing from the detector.

G. Smoke detection sampling points (Tamper Resistant)

1. Tamper-resistant, detention grade detection points shall be used for inmate occupied areas. These detection point locations are designated with an asterisk '*' on the Electrical Construction Sheets. Provide Torx-Center-Pin screws as specified in Specification Section 050553.
 - a. Tamperproof detection points shall be stainless steel.
 - b. Mounting options: Ceiling, Cabinet or open duct.
 - c. Compatible with 6mm microbore tube.
2. The sampling points shall comply with the following requirements:
 - a. Sampling points shall not be separated by more than the maximum distance allowed for conventional point detectors as specified in the local codes and standards. Intervals may vary according to calculations. For NFPA the maximum allowable distance is 30 feet.
 - b. Each sampling point shall be identified in accordance with Codes or Standards.
 - c. Sample point shall have a built-in mechanism to enable sampling point testing and microbore tube integrity testing from the detector.

H. High-Level-Interface (HLI) Units

1. Provide High-Level-Interface equipment at each VESDA smoke detector.
 - a. HLI shall be capable of communicating directly with the Main Fire Alarm Control Panel for the following manufacturers:
 - 1) Notifier
 - 2) Edwards
 - b. For other than the Main Fire Alarm Control Panel manufacturers listed above, provide a zone addressable module (ZAM) relay for monitoring of all alarms and status of detection points including:
 - 1) Each of the forty (40) point-addressable detection points and
 - 2) Each of the five (5) addressable high-level-interface (HLI) alarms and
 - 3) Each of the five (5) "global detector level fire" alarms.

I. Power Supply (Battery Charger and Batteries)

1. Each VESDA detector shall be powered from a Battery/Battery Charger Cabinet. Power shall be a regulated supply of nominally 24V DC. The 120VAC battery charger and 24VDC batteries shall comply with relevant Codes, Standards and Regulations.
 - a. The VESDA detector shall be powered from a regulated supply of nominally 24V DC. The battery charger and batteries shall comply with the relevant Codes, Standards or Regulations.
 - 1) Battery backup shall provide 24 hours' standby, followed by 30 minutes in an alarm condition at maximum connected load.
 - 2) Primary Power: 24-V dc obtained from 120 VAC service.
 - 3) Secondary Power: 24-V dc supply system with batteries, automatic battery charger, and automatic transfer switch.
 - 4) Batteries: Sealed lead calcium.
 - b. Battery sizing calculations for the cabinet shall include the VESDA detector loads. Power supply shall comply with the following:
 - 1) UL 1481 Listed - Power supply and standby batteries shall be appropriately sized/rated to accommodate the system's power requirements.
2. Instructions: Computer printout or typewritten instruction card mounted behind a plastic or glass cover in a stainless-steel or aluminum frame. Include interpretation and describe appropriate response for displays and signals. Briefly describe the functional operation of the system under normal, alarm, and trouble conditions.

J. Microbore Sampling Tubes

1. The microbore sampling tube shall comply with the following requirements:
 - a. Tubes used shall be 0.24" (6mm) OD / 0.16" (4mm) ID and 0.16" (4mm) OD / 0.1" (2.5mm) ID.
 - b. Tubes shall have adequate markings to meet local codes and standards.
 - c. Tubes shall be UL listed / recognized.
 - d. Tubes shall be approved for use in the protected environment.
2. Where false ceilings are installed, the sampling tubes shall be installed above the ceiling, and sampling points shall be installed on the ceiling and connected to the sampling tube.
3. The sampling tubes shall be of the same length or use the manufacturer's guidelines to run tubes of the required lengths using two diameter tubes 0.24" (6mm) and 0.16" (4mm) OD.

4. Maximum tube length shall be up to 328 feet (100m), however shorter tube lengths may be accommodated in accordance with the manufacturer's guidelines.
 - a. Extra tube lengths shall be neatly coiled and supported in a workmanlike manner. Locate coiling where readily accessible and to not obstruct working clearance.
 - b. All tubing for each sample point shall be the same length based on its longest run and shall have a minimum length of 100 feet as required by manufacturer's recommendations.
 5. All joints in the sampling tubes must be air tight and made by using manufacturer recommended connectors.
 6. Sampling tubes shall be installed in raceways and/or sleeves in the following areas:
 - a. Above inaccessible ceilings.
 - b. Finished areas.
 - c. Areas subject to physical damage.
 - d. Ceiling and/or wall penetrations.
 7. Pipe Material: CPVC and complying with UL 1887, "Safety Fire Test of Plastic Sprinkler Pipe for Visible Flame and Smoke Characteristics."
 8. Joints in the sampling pipe shall be airtight. Use solvent cement approved by the pipe manufacturer on all joints except at entry to the detector.
 9. Identify piping with labels reading: "Aspirating Smoke Detector Pipe - Do Not Paint or Disturb" along its entire length at regular intervals according to NFPA 72.
 10. Support pipes at not more than 60-inch centers.
 11. Fit end of each trunk or branch pipe with an end cap and drilled with a hole appropriately sized to achieve the performance as specified and as calculated by the system design.
- K. Sampling Holes:
1. Sampling holes of 5/64 inch, or other sized holes per manufacturer's written instructions, shall be separated by not more than the maximum distance allowable for conventional smoke detectors. Intervals may vary according to calculations.
 2. Follow manufacturer's written recommendations to determine the number and spacing of sampling points and the distance from sampling points to ceiling or roof structure and to forced ventilation systems.
 3. Each sampling point shall be identified by an applied decal.
- L. Warranty
1. VESDA system and components shall comply with the warranty as indicated by Part 1 of this specification.

M. Spare Parts

1. Provide a list of recommended spare parts with the O&M manual. I.e. spare parts list for detector would include:
 - a. Replaceable Pump.
 - b. Replaceable Smoke Sensor Module/Chamber Assembly.
 - c. Replaceable Rotary Valve.
 - d. Replaceable LED Front Cover/LCD Front Cover

N. Installation

1. Contractor shall install the entire detection system in accordance with National and Local Codes and the Manufacturer's System Design Manual.

O. Testing, Demonstration, and Training

1. Commissioning Tests
 - a. The VESDA Manufacturer's Representative shall attend commissioning and demonstration of the entire installation in the presence of the Owner, Engineer, and Authorities Having Jurisdiction.
 - b. All necessary instrumentation, equipment, materials and labor shall be provided by the Contractor.
 - c. The Contractor shall record all tests and system configuration and a copy of these results shall be retained on site in the System Log Book.
2. System Check
 - a. Visually check all microbore tubes to ensure that all tube joints, fittings, sampling points, etc. comply with this Specification.
 - b. Check the system to ensure the following features are operational and programmed in accordance with the specification.
 - 1) Alarm threshold levels (for both day and night settings),
 - 2) Time delays,
 - 3) Number of tubes in use,
 - 4) Detector address,
 - 5) Display address where applicable,
 - 6) Clock time and date,
 - 7) Air flow fault thresholds,
 - 8) Reset button operable,
 - 9) Touch screen operable where applicable,
 - 10) Units set to United States standards.
 - 11) Check to ensure that all ancillary warning devices operate as specified.
 - 12) Check interconnection with Fire Alarm Control Panel to ensure correct operation.

c. Final Tests

1) The Contractor shall:

- a) Introduce smoke into each detection chamber through the local test ports provided on the detector to ensure test ports are functional.
- b) Verify that transport time from the sampling port connected to the longest microbore tube does not exceed the local code requirements using smoke signal rise on the VSC / VSM or the LCD display.
- c) Activate the appropriate Fire Alarm zones and advise all concerned that the system is fully operational. Fill out the logbook and commissioning report accordingly.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine areas and conditions for compliance with requirements for ventilation, temperature, humidity, and other conditions affecting performance of the Work.
 1. Verify that manufacturer's written instructions for environmental conditions have been permanently established in spaces where equipment and wiring are installed, before installation begins.
- B. Examine roughing-in for electrical connections to verify actual locations of connections before installation.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 EQUIPMENT INSTALLATION

- A. Comply with NFPA 72, NFPA 101, and requirements of Authorities Having Jurisdiction for installation and testing of fire-alarm equipment. Install all electrical wiring to comply with requirements in NFPA 70 including, but not limited to, Article 760, "Fire Alarm Systems."
 1. Devices placed in service before all other trades have completed cleanup shall be replaced.
 2. Devices installed but not yet placed in service shall be protected from construction dust, debris, dirt, moisture, and damage according to manufacturer's written storage instructions.

- B. Equipment Mounting: Install fire-alarm control unit on concrete base. Comply with requirements for concrete base specified in Section 033000 "Cast-in-Place Concrete."
1. Install seismic bracing. Comply with requirements in Section 260548.16 "Seismic Controls for Electrical Systems."
 2. Install dowel rods to connect concrete base to concrete floor. Unless otherwise indicated, install dowel rods on 18-inch centers around the full perimeter of concrete base.
 3. For supported equipment, install epoxy-coated anchor bolts that extend through concrete base and anchor into structural concrete floor.
 4. Place and secure anchorage devices. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
 5. Install anchor bolts to elevations required for proper attachment to supported equipment.
- C. Install wall-mounted equipment, with tops of cabinets not more than 78 inches above the finished floor.
1. Comply with requirements for seismic-restraint devices specified in Section 260548.16 "Seismic Controls for Electrical Systems."
- D. Manual Fire-Alarm Boxes:
1. Install manual fire-alarm box in the normal path of egress within 60 inches of the exit doorway.
 2. Mount manual fire-alarm box on a background of a contrasting color.
 3. The operable part of manual fire-alarm box shall be between 42 inches and 48 inches above finished floor level. All devices shall be mounted at the same height unless otherwise indicated.
- E. Smoke- or Heat-Detector Spacing:
1. Comply with the "Smoke-Sensing Fire Detectors" section in the "Initiating Devices" chapter in NFPA 72, for smoke-detector spacing.
 2. Comply with the "Heat-Sensing Fire Detectors" section in the "Initiating Devices" chapter in NFPA 72, for heat-detector spacing.
 3. Smooth ceiling spacing shall not exceed 30 feet.
 4. Spacing of detectors for irregular areas, for irregular ceiling construction, and for high ceiling areas shall be determined according to Annex A or Annex B in NFPA 72.
 5. HVAC: Locate detectors not closer than 60 inches from air-supply diffuser or return-air opening.
 6. Lighting Fixtures: Locate detectors not closer than 12 inches from any part of a lighting fixture and not directly above pendant mounted or indirect lighting.
- F. Install a cover on each smoke detector that is not placed in service to protect during construction. Cover shall remain in place except during system testing. Remove cover prior to system turnover.

- 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.
 - 1. Do not install smoke detector in duct smoke-detector housing during construction. Install detector only during system testing and prior to system turnover.
- H. Air-Sampling Smoke Detectors: If using multiple pipe runs, the runs shall be pneumatically balanced.
- I. 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.
- J. Audible Alarm-Indicating Devices: Install not less than 6 inches below the ceiling. Install 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.
- K. Visible Alarm-Indicating Devices: Install adjacent to each alarm horn and at least 6 inches below the ceiling. Install all devices at the same height unless otherwise indicated.
- L. Device Location-Indicating Lights: Locate in public space near the device they monitor.
- M. Antenna for Digital Cellular Radio Alarm Communicator Transmitter: Mount to building structure where indicated. Use mounting arrangement and substrate connection that resists 100-mph wind load with a gust factor of 1.3 without damage.

3.3 PATHWAYS

- A. Pathways shall be installed in EMT.
- B. Exposed EMT shall be painted red enamel.
- C. Boxes shall be painted red enamel.

3.4 CONNECTIONS

- A. 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. Data communication circuit(s) for connection to Building Management System (BMS) Panel for smoke management system.
 - 2. Alarm-initiating connection to smoke-control system (smoke management) at Firefighters' Smoke-Control System Panel.
 - 3. Alarm-initiating connection to Access System Control Panel.
 - 4. Supervisory connections at standalone Fire Suppression Panels.

5. Supervisory connections at VESDA smoke detectors.
6. Supervisory connections at ANSUL.
7. Supervisory connections at valve supervisory switches.

3.5 IDENTIFICATION

- A. Identify system components, wiring, cabling, and terminals.
- B. Install framed instructions in a location visible from fire-alarm control unit.
- C. Identify system components, wiring, and cabling. Comply with requirements for identification specified in Section 260553 "Identification for Electrical Systems

3.6 GROUNDING

- A. For communications wiring, comply with J-STD-607-A and with BICSI TDMM, "Grounding, Bonding, and Electrical Protection" Chapter.
- B. For low-voltage wiring and cabling, comply with requirements in Section 260526 "Grounding and Bonding for Electrical Systems."
- C. 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.
- D. Ground shielded cables at the control panel location only. Insulate shield at device location.

3.7 CABLING INSTALLATION

- A. Do not install conductors and cables that are wet, moisture damaged, or mold damaged.
 1. Indications that wire and cables are wet or moisture damaged include, but are not limited to, discoloration and sagging of factory packing materials.
- B. Environmental Limitations: Do not deliver or install cables and connecting materials until wet work in spaces is complete and dry, and temporary HVAC system is operating and maintaining ambient temperature and humidity conditions at occupancy levels during the remainder of the construction period.
- C. Comply with NECA 1.
- D. Conductors: Size according to system manufacturer's written instructions unless otherwise indicated.

E. General Requirements for Cabling:

1. Terminate all conductors; no cable shall contain unterminated elements. Make terminations only at indicated outlet and terminals.
2. Cables may not be spliced. Secure and support cables at intervals not exceeding 30 inches and not more than 6 inches from cabinets, boxes, fittings, outlets, racks, frames, and terminals.
3. Bundle, lace, and train conductors to terminal points without exceeding manufacturer's limitations on bending radii.
4. Do not install bruised, kinked, scored, deformed, or abraded cable. Do not splice cable between termination, tap, or junction points. Remove and discard cable if damaged during installation and replace it with new cable.
5. Cold-Weather Installation: Bring cable to room temperature before de-reeling. Heat lamps shall not be used for heating.
6. Pulling Cable: Monitor cable pull tensions.

F. Fire Alarm Wiring Installation

1. Comply with NECA 1 and NFPA 72.
2. Wiring Method: Install wiring in metal raceway according to Section 260533 "Raceways and Boxes for Electrical Systems."
 - a. Install plenum cable in environmental air spaces, including plenum ceilings.
 - b. Fire alarm circuits and equipment control wiring associated with the fire alarm system shall be installed in a dedicated raceway system. This system shall not be used for any other wire or cable.
3. Wiring Method:
 - a. Cables and raceways used for fire alarm circuits, and equipment control wiring associated with the fire alarm system, may not contain any other wire or cable.
 - b. Fire-Rated Cables: Use of 2-hour, fire-rated fire alarm cables, NFPA 70, Types MI and CI, is permitted.
 - c. Signaling Line Circuits: Power-limited fire alarm cables shall not be installed in the same cable or raceway as signaling line circuits.
4. Wiring within Enclosures: Separate power-limited and non-power-limited conductors as recommended by manufacturer. Install conductors parallel with or at right angles to sides and back of the enclosure. Bundle, lace, and train conductors to terminal points with no excess. Connect conductors that are terminated, spliced, or interrupted in any enclosure associated with the fire alarm system to terminal blocks. Mark each terminal according to the system's wiring diagrams. Make all connections with approved crimp-on terminal spade lugs, pressure-type terminal blocks, or plug connectors.
5. Cable Taps: Use numbered terminal strips in junction, pull, and outlet boxes, cabinets, or equipment enclosures where circuit connections are made.

6. Color-Coding: Color-code fire alarm conductors differently from the normal building power wiring. Use one color-code for alarm circuit wiring and another for supervisory circuits. Color-code audible alarm-indicating circuits differently from alarm-initiating circuits. Use different colors for visible alarm-indicating devices. Paint fire alarm system junction boxes and covers red.
7. Wiring to Remote Alarm Transmitting Device: 1-inch conduit between the fire alarm control panel and the transmitter. Install number of conductors and electrical supervision for connecting wiring as needed to suit monitoring function.

G. Power and Control-Circuit Conductors

1. 120-V Power Wiring: Install according to Section 260519 "Low-Voltage Electrical Power Conductors and Cables" unless otherwise indicated.
2. Minimum Conductor Sizes:
 - a. Class 1 remote-control and signal circuits, No. 14 AWG.
 - b. Class 2 low-energy, remote-control and signal circuits, No. 16 AWG.
 - c. Class 3 low-energy, remote-control, alarm and signal circuits, No. 12 AWG.

3.8 FIRESTOPPING

- A. Comply with requirements in Section 078413 "Penetration Firestopping."

3.9 FIELD QUALITY CONTROL

- A. Field tests shall be witnessed by Engineer and Authorities Having Jurisdiction.
- B. Manufacturer's Field Service
1. Fire Alarm System - Engage a factory-authorized service representative to test and inspect components, assemblies, and equipment installations, including connections.
 2. VESDA System - Engage a factory-authorized service representative to test and inspect components, assemblies, and equipment installations, including connections.
- C. Perform tests and inspections.
- D. Perform the following tests and inspections with the assistance of a factory-authorized service representative(s):
1. Visual Inspection: Conduct visual inspection prior to testing.
 - a. Inspection shall be based on completed record Drawings and system documentation that is required by the "Completion Documents, Preparation" table in the "Documentation" section of the "Fundamentals" chapter in NFPA 72.
 - b. Comply with the "Visual Inspection Frequencies" table in the "Inspection" section of the "Inspection, Testing and Maintenance" chapter in NFPA 72; retain the "Initial/Reacceptance" column and list only the installed components.

2. System Testing: Comply with the "Test Methods" table in the "Testing" section of the "Inspection, Testing and Maintenance" chapter in NFPA 72.
 3. Test audible appliances for the public operating mode according to manufacturer's written instructions. Perform the test using a portable sound-level meter complying with Type 2 requirements in ANSI S1.4.
 4. Test audible appliances for the private operating mode according to manufacturer's written instructions.
 5. Test visible appliances for the public operating mode according to manufacturer's written instructions.
 6. Factory-authorized service representative(s) 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.
- E. Reacceptance Testing: Perform reacceptance testing to verify the proper operation of added or replaced devices and appliances.
- F. Fire-alarm system will be considered defective if it does not pass tests and inspections. Refer to Specification Section 014000 "Quality Requirements" for re-testing and re-inspecting requirements. Refer to Specification Section 017300 "Execution" for requirements for correcting the Work.
- G. Prepare test and inspection reports.
- H. Maintenance Test and Inspection: Perform tests and inspections listed for weekly, monthly, quarterly, and semiannual periods. Use forms developed for initial tests and inspections.
- I. 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.

3.10 FIELD QUALITY CONTROL - CABLING

- A. Perform the following tests and inspections with the assistance of a factory-authorized service representative:
1. Visually inspect UTP cable jacket materials for NRTL certification markings. Inspect cabling terminations to confirm color-coding for pin assignments and inspect cabling connections to confirm compliance with TIA/EIA-568-B.1.
 2. Visually inspect cable placement, cable termination, grounding and bonding, equipment and patch cords, and labeling of all components.

3. Test UTP cabling for DC loop resistance, shorts, opens, intermittent faults, and polarity between conductors. Test operation of shorting bars in connection blocks. Test cables after termination but not cross connection.
 - a. Test instruments shall meet or exceed applicable requirements in TIA/EIA-568-B.2. Perform tests with a tester that complies with performance requirements in "Test Instruments (Normative)" Annex, complying with measurement accuracy specified in "Measurement Accuracy (Informative)" Annex. Use only test cords and adapters that are qualified by test equipment manufacturer for channel or link test configuration.
- B. Document data for each measurement. Print data for submittals in a summary report that is formatted using Table 10.1 in BICSI TDMM as a guide or transfer the data from the instrument to the computer, save as text files, print, and submit.
- C. End-to-end cabling will be considered defective if it does not pass tests and inspections.
- D. Prepare test and inspection reports.

3.11 MAINTENANCE SERVICE

- A. Initial Maintenance Service: Beginning at Substantial Completion, provide maintenance service for twelve (12) month with skilled employees of manufacturer's designated service organization. Include preventive maintenance, repair or replacement of worn or defective components, lubrication, cleaning, and adjusting as required for proper operation. Parts and supplies shall be manufacturer's authorized replacement parts and supplies.
 1. Include visual inspections according to the "Visual Inspection Frequencies" table in the "Testing" paragraph of the "Inspection, Testing and Maintenance" chapter in NFPA 72.
 2. Perform tests in the "Test Methods" table in the "Testing" paragraph of the "Inspection, Testing and Maintenance" chapter in NFPA 72.
 3. Perform tests per the "Testing Frequencies" table in the "Testing" paragraph of the "Inspection, Testing and Maintenance" chapter in NFPA 72.

3.12 SOFTWARE SERVICE AGREEMENT

- A. Comply with UL 864.
- B. Technical Support: Beginning at Substantial Completion, service agreement shall include software support for two (2) years.

- C. Firmware Service Upgrades: At Substantial Completion, update software to latest version. Install and program software upgrades that become available within two (2) years from date of Substantial Completion. Upgrading software shall include operating system and new or revised licenses for using software.
 - 1. Upgrade Notice: Provide at least thirty (30) days of advanced notice to the Owner to allow the Owner to schedule access to system and to upgrade computer equipment if necessary.

3.13 DEMONSTRATION AND TRAINING

- A. Engage factory-authorized service representative(s) demonstrate the complete and operable system. Demonstration shall be coordinated with all other Vendors as necessary and shall include demonstration of all components including smoke control systems.
- B. Train Owner's maintenance personnel to adjust, operate, and maintain fire-alarm system. Include training materials with Operation and Maintenance Manual. Training shall include a minimum of four (4) hours of field training and four (4) hours of classroom training for up to thirty (30) persons. Coordinate with Owner to determine classroom/conference room size and location and to determine the number of maintenance personnel that will attend.
- C. Training shall include presentation, demonstration, and pricing to Owner for all the Manufacturer's available software solutions for additional utilization features such as alarming (push notifications) to users at remote locations or monitoring/troubleshooting/testing by users at remote locations.

END OF SECTION 284621.11

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SECTION 312000 - EARTH MOVING

PART 1 - GENERAL

1.1 DEFINITIONS

- A. Backfill: Soil material or controlled low-strength material used to fill an excavation.
 - 1. Initial Backfill: Backfill placed beside and over pipe in a trench, including haunches to support sides of pipe.
 - 2. Final Backfill: Backfill placed over initial backfill to fill a trench.
- B. Base Course: Aggregate layer placed between the subbase course and hot-mix asphalt paving.
- C. Bedding Course: Aggregate layer placed over the excavated subgrade in a trench before laying pipe.
- D. Borrow Soil: Satisfactory soil imported from off-site for use as fill or backfill.
- E. Drainage Course: Aggregate layer supporting the slab-on-grade that also minimizes upward capillary flow of pore water.
- F. Excavation: Removal of material encountered above subgrade elevations and to lines and dimensions indicated.
 - 1. Authorized Additional Excavation: Excavation below subgrade elevations or beyond indicated lines and dimensions as directed by Construction Manager. Authorized additional excavation and replacement material will be paid for according to Contract provisions changes in the Work.
 - 2. Unauthorized Excavation: Excavation below subgrade elevations or beyond indicated lines and dimensions without direction by Construction Manager. Unauthorized excavation, as well as remedial work directed by Construction Manager, shall be without additional compensation.
- G. Fill: Soil materials used to raise existing grades.
- H. Structures: Buildings, footings, foundations, retaining walls, slabs, tanks, curbs, mechanical and electrical appurtenances, or other man-made stationary features constructed above or below the ground surface.
- I. Subbase Course: Aggregate layer placed between the subgrade and base course for hot-mix asphalt pavement, or aggregate layer placed between the subgrade and a cement concrete pavement or a cement concrete or hot-mix asphalt walk.
- J. Subgrade: Uppermost surface of an excavation or the top surface of a fill or backfill immediately below subbase, drainage fill, drainage course, or topsoil materials.

- K. Utilities: On-site underground pipes, conduits, ducts, and cables as well as underground services within buildings.

1.2 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct pre-excavation conference at Project site.
 - 1. Review methods and procedures related to earthmoving, including, but not limited to, the following:
 - a. Personnel and equipment needed to make progress and avoid delays.
 - b. Coordination of Work with utility locator service.
 - c. Coordination of Work and equipment movement with the locations of tree- and plant-protection zones.
 - d. Extent of trenching by hand or with air spade.
 - e. Field quality control.
 - f. Ground improvement practices.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of the following manufactured products required:
 - 1. Geotextiles.
 - 2. Controlled low-strength material, including design mixture.
 - 3. Warning tapes.
 - 4. Engineered Fill

1.4 INFORMATIONAL SUBMITTALS

- A. Material Test Reports: For each on-site and borrow soil material proposed for fill and backfill as follows:
 - 1. Classification according to ASTM D 2487.
 - 2. Laboratory compaction curve according to ASTM D 698.
- B. Pre-excavation Photographs or Videotape: Show existing conditions of adjoining construction and site improvements, including finish surfaces that might be misconstrued as damage caused by earth-moving operations. Submit before earth moving begins.

1.5 QUALITY ASSURANCE

- A. Geotechnical Testing Agency Qualifications: Qualified according to ASTM E 329 and ASTM D 3740 for testing indicated.
 - 1. To be provided by the Owner.

1.6 FIELD CONDITIONS

- A. Traffic: Minimize interference with adjoining roads, streets, walks, and other adjacent occupied or used facilities during earth-moving operations.
 - 1. Do not close or obstruct streets, walks, or other adjacent occupied or used facilities without permission from Owner and authorities having jurisdiction.
 - 2. Provide alternate routes around closed or obstructed traffic ways if required by Owner or authorities having jurisdiction.
- B. Utility Locator Service: Notify 811-Call Before You Dig for area where Project is located before beginning earth-moving operations.
- C. Do not commence earth-moving operations until temporary site fencing and erosion- and sedimentation-control measures specified in Section 311000 "Site Clearing" are in place.

PART 2 - PRODUCTS

2.1 SOIL MATERIALS

- A. General: Provide borrow soil materials when sufficient satisfactory soil materials are not available from excavations.
- B. Satisfactory Soils: Soil Classification Groups GW, GP, GM, SW, SP, and SM according to ASTM D2487, or a combination of these groups; free of rock or gravel larger than 3 inches in any dimension, debris, waste, frozen materials, vegetation, and other deleterious matter.
- C. Unsatisfactory Soils: Soil Classification Groups GC, SC, CL, ML, OL, CH, MH, OH, and PT according to ASTM D2487, or a combination of these groups.
 - 1. Unsatisfactory soils also include satisfactory soils not maintained within 2 percent of optimum moisture content at time of compaction.
- D. Subbase Material: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand; ASTM D 2940/D 2940M; with at least 90 percent passing a 1-1/2-inch (37.5-mm) sieve and not more than 12 percent passing a No. 200 sieve.
- E. Base Course: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand; ASTM D 294/D 2940M 0; with at least 95 percent passing a 1-1/2-inch (37.5-mm) sieve and not more than 8 percent passing a No. 200 sieve.
- F. Surface Course: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand; ASTM D 294/D 2940M 0; with at least 95 percent passing a 1-inch (25-mm) sieve and not more than 9 percent passing a No. 200 sieve.

- G. Engineered Fill: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand; ASTM D 2940/D 2940M; with at least 90 percent passing a 1-1/2-inch (37.5-mm) sieve and not more than 12 percent passing a No. 200 sieve.
- H. Bedding Course: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand; ASTM D 2940/D 2940M; except with 100 percent passing a 1-inch (25-mm) sieve and not more than 8 percent passing a No. 200 sieve.
- I. Drainage Course: INDOT No. 53
- J. Filter Material: Narrowly graded mixture of natural or crushed gravel, or crushed stone and natural sand; ASTM D 448; coarse-aggregate grading Size 67; with 100 percent passing a 1-inch (25-mm) sieve and zero to 5 percent passing a No. 4 sieve.
- K. Sand: ASTM C 33/C 33M; fine aggregate.
- L. Impervious Fill: Clayey gravel and sand mixture capable of compacting to a dense state.

2.2 GEOTEXTILES

- A. Subsurface Drainage Geotextile: Nonwoven needle-punched geotextile, manufactured for subsurface drainage applications, made from polyolefins or polyesters; with elongation greater than 50 percent; complying with AASHTO M 288 and the following, measured per test methods referenced:
 - 1. Survivability: As follows:
 - a. Grab Tensile Strength: 157 lbf (700 N); ASTM D 4632.
 - b. Sewn Seam Strength: 142 lbf (630 N); ASTM D 4632.
 - c. Tear Strength: 56 lbf (250 N); ASTM D 4533.
 - d. Puncture Strength: 56 lbf (250 N); ASTM D 4833.
 - 2. Apparent Opening Size: No. 70 (0.212-mm) sieve, maximum; ASTM D 4751.
 - 3. Permittivity: 0.1 per second, minimum; ASTM D 4491.
 - 4. UV Stability: 50 percent after 500 hours' exposure; ASTM D 4355.

2.3 CONTROLLED LOW-STRENGTH MATERIAL

- A. Controlled Low-Strength Material: Self-compacting, flowable concrete material produced from the following:
 - 1. Portland Cement: ASTM C 150/C 150M, Type I/II.
 - 2. Fly Ash: ASTM C 618, Class C or F.
 - 3. Normal-Weight Aggregate: ASTM C 33/C 33M, 3/8-inch nominal maximum aggregate size.
 - 4. Water: ASTM C 94/C 94M.
 - 5. Air-Entraining Admixture: ASTM C 260/C 260M.

- B. Produce conventional-weight, controlled low-strength material with 80-psi (550-kPa) compressive strength when tested according to ASTM C 495/C 495M.

2.4 ACCESSORIES

- A. Warning Tape: Acid- and alkali-resistant, polyethylene film warning tape manufactured for marking and identifying underground utilities, 6 inches wide and 4 mils thick, continuously inscribed with a description of the utility; colored as follows:
 - 1. Red: Electric.
 - 2. Yellow: Gas, oil, steam, and dangerous materials.
 - 3. Orange: Telephone and other communications.
 - 4. Blue: Water systems.
 - 5. Green: Sewer systems.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Protect structures, utilities, sidewalks, pavements, and other facilities from damage caused by settlement, lateral movement, undermining, washout, and other hazards created by earth-moving operations.
- B. Protect and maintain erosion and sedimentation controls during earth-moving operations.
- C. Protect subgrades and foundation soils from freezing temperatures and frost. Remove temporary protection before placing subsequent materials.

3.2 DEWATERING

- A. Prevent surface water and ground water from entering excavations, from ponding on prepared subgrades, and from flooding Project site and surrounding area.
- B. Protect subgrades from softening, undermining, washout, and damage by rain or water accumulation.
 - 1. Reroute surface water runoff away from excavated areas. Do not allow water to accumulate in excavations. Do not use excavated trenches as temporary drainage ditches.

3.3 EXPLOSIVES

- A. Explosives: Do not use explosives.

3.4 EXCAVATION, GENERAL

- A. Unclassified Excavation: Excavate to subgrade elevations regardless of the character of surface and subsurface conditions encountered. Unclassified excavated materials may include rock, soil materials, and obstructions. No changes in the Contract Sum or the Contract Time will be authorized for rock excavation or removal of obstructions.
 - 1. If excavated materials intended for fill and backfill include unsatisfactory soil materials and rock, replace with satisfactory soil materials.
 - 2. Remove rock to lines and grades indicated to permit installation of permanent construction without exceeding the following dimensions:
 - a. 24 inches outside of concrete forms other than at footings.
 - b. 12 inches outside of concrete forms at footings.
 - c. 6 inches outside of minimum required dimensions of concrete cast against grade.
 - d. Outside dimensions of concrete walls indicated to be cast against rock without forms or exterior waterproofing treatments.
 - e. 6 inches beneath bottom of concrete slabs-on-grade.
 - f. 6 inches beneath pipe in trenches and the greater of 24 inches wider than pipe or 42 inches wide.

3.5 EXCAVATION FOR STRUCTURES

- A. Excavate to indicated elevations and dimensions within a tolerance of plus or minus 1 inch. If applicable, extend excavations a sufficient distance from structures for placing and removing concrete formwork, for installing services and other construction, and for inspections.
 - 1. Excavations for Footings and Foundations: Do not disturb bottom of excavation. Excavate by hand to final grade just before placing concrete reinforcement. Trim bottoms to required lines and grades to leave solid base to receive other work.
- B. Excavations at Edges of Tree- and Plant-Protection Zones:
 - 1. Excavate by hand or with an air spade to indicated lines, cross sections, elevations, and subgrades. If excavating by hand, use narrow-tine spading forks to comb soil and expose roots. Do not break, tear, or chop exposed roots. Do not use mechanical equipment that rips, tears, or pulls roots.

3.6 EXCAVATION FOR WALKS AND PAVEMENTS

- A. Excavate surfaces under walks and pavements to indicated lines, cross sections, elevations, and subgrades.

3.7 EXCAVATION FOR UTILITY TRENCHES

- A. Excavate trenches to indicated gradients, lines, depths, and elevations.

1. Beyond building perimeter, excavate trenches to allow installation of top of pipe below frost line.
- B. Excavate trenches to uniform widths to provide the following clearance on each side of pipe or conduit. Excavate trench walls vertically from trench bottom to 12 inches higher than top of pipe or conduit unless otherwise indicated.
 1. Clearance: 6 inches each side of pipe or conduit.
- C. Water and Conduits
 1. Trench Bottoms: Excavate and shape trench bottoms to provide uniform bearing and support of pipes and conduit. Shape subgrade to provide continuous support for bells, joints, and barrels of pipes and for joints, fittings, and bodies of conduits. Remove projecting stones and sharp objects along trench subgrade.
 - a. For pipes and conduit less than 6 inches in nominal diameter, hand-excavate trench bottoms and support pipe and conduit on an undisturbed subgrade.
 - b. For pipes and conduit 6 inches or larger in nominal diameter, shape bottom of trench to support bottom 90 degrees of pipe or conduit circumference. Fill depressions with tamped sand backfill.
 - c. For flat-bottomed, multiple-duct conduit units, hand-excavate trench bottoms and support conduit on an undisturbed subgrade.
 - d. Excavate trenches 6 inches deeper than elevation required in rock or other unyielding bearing material to allow for bedding course.
- D. Storm and Sanitary Sewer
 1. Trench Bottoms: Excavate trenches 4 inches deeper than bottom of pipe and conduit elevations to allow for bedding course. Hand-excavate deeper for bells of pipe.
 - a. Excavate trenches 6 inches deeper than elevation required in rock or other unyielding bearing material to allow for bedding course.

3.8 SUBGRADE INSPECTION

- A. Notify Construction Manager when excavations have reached required subgrade.
- B. If Construction Manager determines that unsatisfactory soil is present, continue excavation and replace with compacted backfill or fill material as directed.
- C. Proof-roll subgrade pavements with a pneumatic-tired and loaded 10-wheel, tandem-axle dump truck weighing not less than 15 tons to identify soft pockets and areas of excess yielding. Do not proof-roll wet or saturated subgrades.
 1. Completely proof-roll subgrade in one direction. Limit vehicle speed to 3 mph.

2. Excavate soft spots, unsatisfactory soils, and areas of excessive pumping or rutting, as determined by Construction Manager, and replace with compacted backfill or fill as directed.
- D. Authorized additional excavation and replacement material will be paid for according to Contract provisions for changes in the Work.
- E. Reconstruct subgrades damaged by freezing temperatures, frost, rain, accumulated water, or construction activities, as directed by Construction Manager, without additional compensation.

3.9 UNAUTHORIZED EXCAVATION

- A. Fill unauthorized excavation under foundations or wall footings by extending bottom elevation of concrete foundation or footing to excavation bottom, without altering top elevation. Lean concrete fill, with 28-day compressive strength of 2500 psi, may be used when approved by Construction Manager.
 1. Fill unauthorized excavations under other construction, pipe, or conduit as directed by Construction Manager.

3.10 STORAGE OF SOIL MATERIALS

- A. Stockpile borrow soil materials and excavated satisfactory soil materials without intermixing. Place, grade, and shape stockpiles to drain surface water. Cover to prevent windblown dust.
 1. Stockpile soil materials away from edge of excavations. Do not store within drip line of remaining trees.

3.11 BACKFILL

- A. Place and compact backfill in excavations promptly, but not before completing the following:
 1. Construction below finish grade including, where applicable, sub-drainage, damp proofing, waterproofing, and perimeter insulation.
 2. Surveying locations of underground utilities for Record Documents.
 3. Removing concrete formwork.
 4. Removing trash and debris.
 5. Removing temporary shoring, bracing, and sheeting.
 6. Installing permanent or temporary horizontal bracing on horizontally supported walls.
- B. Place backfill on subgrades free of mud, frost, snow, or ice.

3.12 UTILITY TRENCH BACKFILL

- A. Place backfill on subgrades free of mud, frost, snow, or ice.
- B. Place and compact bedding course on trench bottoms and where indicated. Shape bedding course to provide continuous support for bells, joints, and barrels of pipes and for joints, fittings, and bodies of conduits.
- C. Trenches under Footings: Backfill trenches excavated under footings and within 18 inches of bottom of footings with satisfactory soil; fill with concrete to elevation of bottom of footings. Concrete is specified in Section 033000 "Cast-in-Place Concrete."
- D. Trenches under Roadways: Provide 4-inch thick, concrete-base slab support for piping or conduit less than 30 inches below surface of roadways. After installing, completely encase piping or conduit in a minimum of 4 inches of concrete before backfilling or placing roadway subbase course. Concrete is specified in Section 033000 "Cast-in-Place Concrete." Backfill voids with satisfactory soil while removing shoring and bracing.
- E. Initial Backfill:
 - 1. Soil Backfill: Place and compact initial backfill of subbase material or satisfactory soil, free of particles larger than 1 inch (25 mm) in any dimension, to a height of 12 inches (300 mm) over the pipe or conduit.
 - a. Carefully compact initial backfill under pipe haunches and compact evenly up on both sides and along the full length of piping or conduit to avoid damage or displacement of piping or conduit.
- F. Final Backfill:
 - 1. Soil Backfill: Place and compact final backfill of satisfactory soil to final subgrade elevation.
- G. Warning Tape: Install warning tape directly above utilities, 12 inches below finished grade, except 6 inches below subgrade under pavements and slabs.

3.13 SOIL FILL

- A. Plow, scarify, bench, or break up sloped surfaces steeper than 1 vertical to 4 horizontal so fill material will bond with existing material.
- B. Place and compact fill material in layers to required elevations, and as follows:
 - 1. Under grass and planted areas, use satisfactory soil material.
 - 2. Under walks and pavements, use satisfactory soil material.
 - 3. Under steps and ramps, use engineered fill.
 - 4. Under building slabs, use engineered fill.
 - 5. Use engineered soils for bioswales.

- 6. Under footings and foundations, use engineered fill.
- C. Place soil fill on subgrades free of mud, frost, snow, or ice.

3.14 SOIL MOISTURE CONTROL

- A. Uniformly moisten or aerate subgrade and each subsequent fill or backfill soil layer before compaction to within 2 percent of optimum moisture content.
 - 1. Do not place backfill or fill soil material on surfaces that are muddy, frozen, or contain frost or ice.
 - 2. Remove and replace, or scarify and air dry, otherwise satisfactory soil material that exceeds optimum moisture content by 2 percent and is too wet to compact to specified dry unit weight.

3.15 COMPACTION OF SOIL BACKFILLS AND FILLS

- A. Place backfill and fill soil materials in layers not more than 8 inches in loose depth for material compacted by heavy compaction equipment and not more than 4 inches (100 mm) in loose depth for material compacted by hand-operated tampers.
- B. Place backfill and fill soil materials evenly on all sides of structures to required elevations and uniformly along the full length of each structure.
- C. Compact soil materials to not less than the following percentages of maximum dry unit weight according to ASTM D 698:
 - 1. Under structures, building slabs, and steps, scarify and recompact top 12 inches of existing subgrade and each layer of backfill or fill soil material at 100 percent.
 - 2. Under walkways, scarify and recompact top 6 inches below subgrade and compact each layer of backfill or fill soil material at 95 percent.
 - 3. Under turf or unpaved areas, scarify and recompact top 6 inches below subgrade and compact each layer of backfill or fill soil material at 85 percent.
 - 4. Under pavement, the upper 10 inches of subgrade shall be scarified and compacted to a dry density of at least 100-percent of the Standard Proctor maximum dry density (ASTM D-698). Any grade-raise fill placed within 1-ft of the base of the pavement section should also be compacted to at least 100 percent of the Standard Proctor maximum dry density. This can be reduced to 95-percent for engineered fill placed more than 1-ft below the base of the pavement section.
- D. Locate and install ground improvement as indicated in ground improvement drawings and as directed by ground improvement specialty structural engineer.

3.16 GRADING

- A. General: Uniformly grade areas to a smooth surface, free of irregular surface changes. Comply with compaction requirements and grade to cross sections, lines, and elevations indicated.
 - 1. Provide a smooth transition between adjacent existing grades and new grades.
 - 2. Cut out soft spots, fill low spots, and trim high spots to comply with required surface tolerances.
- B. Site Rough Grading: Slope grades to direct water away from buildings and to prevent ponding. Finish subgrades to elevations required to achieve indicated finish elevations, within the following subgrade tolerances:
 - 1. Turf or Unpaved Areas: Plus or minus 1 inch.
 - 2. Walks: Plus or minus 1 inch.
 - 3. Pavements: Plus or minus 1/2 inch.
- C. Grading inside Building Lines: Finish subgrade to a tolerance of 1/2 inch when tested with a 10-foot straightedge.

3.17 SUBSURFACE DRAINAGE

- A. Subdrainage Pipe: Specified in Section 334600 "Subdrainage."
- B. Subsurface Drain: Place subsurface drainage geotextile around perimeter of subdrainage trench. Place a 6-inch course of filter material on subsurface drainage geotextile to support subdrainage pipe. Encase subdrainage pipe in a minimum of 12 inches of filter material, placed in compacted layers 6 inches thick, and wrap in subsurface drainage geotextile, overlapping sides and ends at least 6 inches.
 - 1. Compact each filter material layer to 85 percent of maximum dry unit weight according to ASTM D 698.

3.18 SUBBASE AND BASE COURSES UNDER PAVEMENTS AND WALKS

- A. Place subbase course and base course on subgrades free of mud, frost, snow, or ice.
- B. On prepared subgrade, place subbase course and base course under pavements and walks as follows:
 - 1. Install separation geotextile on prepared subgrade according to manufacturer's written instructions, overlapping sides and ends.
 - 2. Place base course material over subbase course under hot-mix asphalt pavement.
 - 3. Shape subbase course and base course to required crown elevations and cross-slope grades.
 - 4. Place subbase course and base course 6 inches or less in compacted thickness in a single layer.

5. Place subbase course that exceeds 6 inches in compacted thickness in layers of equal thickness, with no compacted layer more than 6 inches thick or less than 3 inches thick.
 6. Compact subbase course and base course at optimum moisture content to required grades, lines, cross sections, and thickness to not less than 95 percent of maximum dry unit weight according to ASTM D 698
- C. Pavement Shoulders: Place shoulders along edges of subbase course and base course to prevent lateral movement. Construct shoulders, at least 12 inches wide, of satisfactory soil materials and compact simultaneously with each subbase and base layer to not less than 95 percent of maximum dry unit weight according to ASTM D 698.

3.19 DRAINAGE COURSE

- A. Place drainage course on subgrades free of mud, frost, snow, or ice.
- B. On prepared subgrade, place and compact drainage course under cast-in-place concrete slabs-on-grade as follows:
1. Install subdrainage geotextile on prepared subgrade according to manufacturer's written instructions, overlapping sides and ends.
 2. Place drainage course 6 inches or less in compacted thickness in a single layer.
 3. Place drainage course that exceeds 6 inches in compacted thickness in layers of equal thickness, with no compacted layer more than 6 inches thick or less than 3 inches thick.
 4. Compact each layer of drainage course to required cross sections and thicknesses to not less than 95 percent of maximum dry unit weight according to ASTM D 698.

3.20 FIELD QUALITY CONTROL

- A. Special Inspections: Owner will engage a qualified special inspector to perform the following special inspections:
1. Determine prior to placement of fill that site has been prepared in compliance with requirements.
 2. Determine that fill material classification and maximum lift thickness comply with requirements.
 3. Determine, during placement and compaction, that in-place density of compacted fill complies with requirements.
- B. Testing Agency: Owner will engage a qualified geotechnical engineering testing agency to perform tests and inspections.
- C. Allow testing agency to inspect and test subgrades and each fill or backfill layer. Proceed with subsequent earth moving only after test results for previously completed work comply with requirements.
- D. Footing Subgrade: At footing subgrades, at least one test of each soil stratum will be performed to verify design bearing capacities. Subsequent verification and approval of other

footing subgrades may be based on a visual comparison of subgrade with tested subgrade when approved by Construction Manager.

- E. Testing agency will test compaction of soils in place according to ASTM D 1556, ASTM D 2167, ASTM D 2937, and ASTM D 6938, as applicable. Tests will be performed at the following locations and frequencies:
 - 1. At subgrade and at each compacted fill and backfill layer, at least one test for every 5000 sq. ft. or less of paved area or building slab but in no case fewer than three tests.
- F. When testing agency reports that subgrades, fills, or backfills have not achieved degree of compaction specified, scarify and moisten or aerate, or remove and replace soil materials to depth required; recompact and retest until specified compaction is obtained.

3.21 PROTECTION

- A. Protecting Graded Areas: Protect newly graded areas from traffic, freezing, and erosion. Keep free of trash and debris.
- B. Repair and reestablish grades to specified tolerances where completed or partially completed surfaces become eroded, rutted, settled, or where they lose compaction due to subsequent construction operations or weather conditions.
 - 1. Scarify or remove and replace soil material to depth as directed by Construction Manager; reshape and recompact.
- C. Where settling occurs before Project correction period elapses, remove finished surfacing, backfill with additional soil material, compact, and reconstruct surfacing.
 - 1. Restore appearance, quality, and condition of finished surfacing to match adjacent work, and eliminate evidence of restoration to greatest extent possible.

3.22 DISPOSAL OF SURPLUS AND WASTE MATERIALS

- A. Remove surplus satisfactory soil and waste materials, including unsatisfactory soil, trash, and debris, and legally dispose of them off Owner's property.

END OF SECTION 312000

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SECTION 333245 – HORIZONTAL SHAFT COMMUNUTERS

PART 1 - GENERAL

1.1 SUMMARY

- A. This section specifies equipment for the mechanical reduction in size of debris from incoming wastewater by means of a hydraulically driven comminutor. The comminutor shall be self-cleaning by means of the liquid flow through the device. The equipment shall be installed as shown on the plans, as recommended by the supplier, and in compliance with all OSHA, local, state and federal codes and regulations.
- B. Each comminutor shall include an overflow bar rack, drive system and electrical control panel.

1.2 REFERENCES

- A. The following industry standards shall be used in the manufacture of the comminutor:
 - 1. American Society for Testing and Materials (ASTM) D3753-81: Fiber-Reinforced Polyester Manholes. American Society for Testing and Materials (ASTM) A36: Carbon Steel Plate
 - 2. American Society for Testing and Materials (ASTM) A536-84: Ferritic Ductile Iron Castings
 - 3. American Society for Testing and Materials (ASTM) A48-83: Grey Iron Casting
 - 4. American National Standards Institute (ANSI) B16.42-1979, Class 150 Flanges
 - 5. American Iron and Steel Institute (AISI) 303 Stainless Steel
 - 6. American Iron and Steel Institute (AISI) 304 Stainless Steel
 - 7. American Iron and Steel Institute (AISI) 316 Stainless Steel
 - 8. American Iron and Steel Institute (AISI) 4130 Heat Treated Alloy Steel
 - 9. American Iron and Steel Institute (AISI) 4140 Heat Treated Alloy Steel
 - 10. American Iron and Steel Institute (AISI) 8620 Heat Treated Alloy Steel
 - 11. American Iron and Steel Institute (AISI) 17-4 Stainless Steel
 - 12. Society of Automotive Engineers (SAE) 660 Bearing Bronze
- B. Controllers shall, as applicable, meet the requirements of the following Regulatory Agencies:
 - 1. National Electrical Manufacturer's Association (NEMA) Standards

2. National Electric Code (NEC)
3. Underwriters Laboratory (UL and cUL)
4. International Electrotechnical Commission (IEC)

1.3 SUBMITTALS

- A. Shop drawings and product data shall be provided for engineering approval 30 days from receipt of order. Operating & Maintenance Manuals shall include equipment descriptions, operating instructions, drawings, troubleshooting techniques, a recommended schedule, and the recommended lubricants.

1.4 WARRANTY

- A. The horizontal shaft comminutor shall be covered against manufacturing defects in materials and workmanship during normal use and service, as long as periodic maintenance procedures are followed and performed, for a period of one (1) year from date of substantial completion.
- B. Cutting blades are not covered by the warranty.

1.5 SYSTEM STARTUP

- A. Initial horizontal shaft comminutor equipment startup procedures shall be performed by the Manufacturer's personnel and/or authorized representative. Detailed startup procedure instructions shall be included in the Manufacturer's Operating & Maintenance Manual.

1.6 OWNER'S INSTRUCTIONS

- A. Operating & Maintenance Manuals that include the following sections shall be supplied with the equipment:
 1. Mechanical, Electrical & Hydraulic Drawings
 2. Job Information, Product Brochures, Warranty Information
 3. Mechanical Specifications
- B. Standard Operating Procedures
 1. Sequence of Operation
 2. Startup, Manual, and Automatic Operation Procedures
 3. Shutdown Procedure
 4. Alarms & Troubleshooting
- C. Maintenance Procedures
- D. Mechanical Equipment Information
- E. Electrical Equipment Information

F. Hydraulic Equipment Information

G. Spare Parts Information

1.7 Quality Assurance

A. Identification

1. Equipment shall be identified with a corrosion resistant nameplate affixed in a conspicuous location.
2. Nameplate information shall include manufacturer's name and address, equipment model number, and serial number.

B. Manufacturer

1. Supplier shall be ISO9001 certified and have a minimum 30 years experience as a manufacturer of municipal waste water equipment and a minimum 5,000 prior installations of similar equipment.
2. Supplier shall provide a list of reference sites for similar equipment for verification by the Engineer or Owner's Representative.
3. Supplier shall conduct factory testing and verification of equipment prior to shipment.
4. Supplier shall have factory owned bi-coastal service centers.

C. Installation & Start-up

1. Supplier shall provide services of a factory trained representative to check installation and review start-up of equipment and controls.
2. Supplier Representative shall inspect and approve site installation and supervise a review of the operation of the equipment.
3. Supplier Representative shall provide training on operation and maintenance requirements of the equipment.

1.8 Delivery, Storage and Handling

A. Packaging

1. Containers or skids shall be constructed for normal shipping, handling, and storage.
2. Containers shall provide adequate protection for the equipment in a dry indoor environment between +40° F (+4.5° C) and +100° F (+37.8° C).

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Mechanical Muffin Monster Manhole shall be in accordance with these specification and plans and shall be supplied by one of the following manufacturers:
1. JWC Environmental, 2850 Red Hill Avenue, Suite #125, Santa Ana, CA 92705
Tel: 800-331-2277
www.jwce.com
 2. Approved equal.
- B. Manufacturers requesting to be selected as an approved equal shall submit certified documentation including installation lists with phone numbers, equipment drawings, flow performance curves, electrical schematics and cut sheets, O&M draft showing compliance with these specifications a minimum of ten (10) days prior to bid opening. Selected equipment manufacturers shall be added to the list of approved manufacturers.
- C. Selected approved equal manufacturers shall conduct an onsite test within ten (10) days of installation demonstrating compliance with all areas of this specification.

2.2 MUFFIN MONSTER MANHOLE

A. Summary

Grinder shall reduce or shred influent solids for protection of downstream equipment. Grinder shall be two shafted design consisting of individual cutters and spacers of equal diameter on both shafts. Grinder shall have high flow or slotted side rails. Grinder shall have an immersible motor and speed reducer for cutter drive.

Each manhole shall have a minimum ½-inch wall thickness, able to withstand a static load of 150 lb/ft per foot of depth with less than ¼-inch deflection. The manhole shall be fabricated with polyester resin, in one integral piece that is structurally strong, lightweight, watertight and corrosion resistant to salt water, ground water, corrosive soil conditions and many commonly encountered industrial chemicals.

The interior surface shall have a smooth white isophthalic gelcoat surface integral to the laminate and not applied as a spray on secondary process.

B. Grinder Components

1. Cutters and Spacers
 - a. Cutting stack shall be a nominal height of 8 inches (203 mm).
 - b. Cutter shall be an individual disk constructed of hardened alloy steel surface ground to thickness of .438-inches +.000/-.001 (11 mm +.000/-.003).

- c. Cutters shall be heat treated to produce a hardness of 60-65 Rockwell C.
- d. Cutters shall have 17 Serrated cam shaped teeth. Tooth height shall not be greater than ½-inch (13 mm) above the root diameter of the cutter.
- e. Spacers shall be an individual disk constructed of hardened alloy steel surface ground to a thickness of .446-inches +.001/-.000 (11.3 mm +.003/-.000).
- f. Spacers shall have a hardness of 40-45 Rockwell C.
- g. Spacers shall have a smooth outside diameter with no tooth profiles.

2. Shafts

- a. Shafts shall be ASTM 4140 alloy steel with a minimum tensile strength of 149,000 PSI (1,027 kPa).
- b. Shafts shall be measure a nominal 2-inches (51 mm) across flats of hex.
- c. Shafts shall be hardened to 38-42 Rockwell C.

3. Seal Cartridges

- a. Seal cartridges shall be rated to a maximum of 90 PSI (620 kPa).
- b. Seal cartridges shall not require flushing.
- c. Dynamic and rotating seal faces shall be tungsten carbide with 6% nickel binder.
- d. O-rings shall be constructed of Buna-N (Nitrile).
- e. Radial and axial loads shall be borne by sealed, oversized, deep-groove ball bearings.

4. Housings and Covers

- a. Top cover and end housings shall be ASTM A536-84 ductile iron.
- b. Bottom cover shall be ASTM A36 steel.
- c. End housing shall have integral bushing deflectors to guide solids away from seal cartridges.
- d. End housings shall have directional flow arrows cast into the external side walls.

5. Side Rails

- a. Side rails shall be ASTM A536-84 ductile iron.

- b. Side rails shall have evenly-spaced horizontal slots to increase flow and decrease water head loss through the grinder. Slots shall only be located on the upstream or influent side of the rail and the effluent side of the rail shall be void of slots to allow for unobstructed flow.
 - c. Inside profile of the cutters shall be concave and follow the radial arc of the cutters.
 - d. Clearance between the outside diameter of cutters and concave arc of the side rail shall not exceed 5/16-inch (7.9 mm).
- 6. Speed Reducer
 - a. Reducer shall be manufactured by Sumitomo Machinery Corporation of America.
 - b. Reducer shall be internal planetary mechanism with trochoidal curved tooth profile.
 - c. Reducer shall be a vertically mounted with 29:1 single reduction.
 - d. Reducer shall be grease lubricated.
- 7. Motor
 - a. Motor shall be manufactured by Baldor Electric Company.
 - b. Motor shall be XPNV immersible – type, 5 hp (3.75 kW), 1770 rpm, 208- 230/460 volt, 3 phase, 60 Hz. and shall have a 40' power cable factory installed.
 - c. Motor shall have a minimum service factor of 1.15, 91% minimum efficiency factor at full load, minimum 76% power factor at full load and rated at UL NEMA 6P (IP67+).

C. Manhole Components

- 1. Fiberglass barrel shall be 48 inches (121.92 cm) in diameter.
- 2. Inlet and outlet pipe stubs, 6 inch (15.24 cm), 8 inch (20.32 cm), 10 inch (25.4 cm), or 12 inch (30.48 cm) with corresponding slip flange bolting connections for connection to incoming and outgoing pipes shall be supplied.
- 5. Stainless steel (T-304) anchoring brackets (4) for anchoring manhole to concrete base shall be supplied.
- 6. A ½ inch (1.27 cm) thick expanded polystyrene bead board for placement on concrete slab under manhole shall be supplied.
- 7. Internally-mounted fiberglass ladder with non-slip traction surface (meet or exceed OSHA General Industry Standards, Part 1910.27 for “Fixed Ladders” shall be supplied.

8. Non-traffic areas above grade manhole shall have lockable fiberglass lid able to withstand 1000 lbs. (453.6 kg) topload.
9. Traffic area manhole shall have concentric manway able to withstand 16,000 (7257.5 kg) vertical dynamic wheel load plus lateral forces with opening of 28 inches (71.12 cm) I.D. min. for use with cast-iron cover. To be supplied by other.
10. Factory installed and tested internally-mounted 306 SS (316 SS optional) guide rails for grinder installation and removal shall be supplied.

D. CONTROLLER

1. Controller shall provide control of the grinder and be designed to control one (1) 5 hp motor at 208-230/460 volts, 3 phase, 60 Hz. The controller shall have indicator lights, switches and other control devices.
 - a. Enclosure shall be fiberglass reinforced polyester NEMA 4X .
 - b. Enclosure shall house the control devices, motor starters, and PLC.
 - c. Grinder ON-OFF/RESET-REMOTE three-position 22mm type, NEMA 4X selector switch
 - d. In the OFF/RESET position, the grinder shall not run.

2.3 GRINDER PERFORMANCE

1. The grinder will be capable of processing up to 335 GPM (31 L/S) with a minimum headloss of eight (8) inches (203 mm) based on clear wastewater at a typical downstream water level of four (4) inches (102 mm).
2. Grinder shall provide peak shaft torque of 4,756 lb-in/hp (721 Nm/kW).
3. Grinder shall provide peak force at cutter tip of 2,051 lb_f/hp (12,234 N/kW).
 - a. In the ON position, the grinder shall run continuously.
 - b. In the REMOTE position, the grinder shall start and stop as controlled by an external device.
 - c. Selector switch shall be the only method for resetting the controller after a failure.
4. Pilot Lights
 - a. Lights shall be LED type 22 mm, rated NEMA 4X.
 - b. Lights shall indicate POWER ON, RUN, and FAIL.

5. Programmable Logic Controller (PLC)
 - a. PLC shall be manufactured by Panasonic.
 - b. PLC shall have a minimum of 16K of memory.
6. Motor Starter
 - a. Starter shall be a full-voltage reversing type with 120 volt operating coils.
 - b. Overload relays shall be adjustable and sized to full load amperes (FLA) of the motor.
7. Control Transformer
 - a. Control transformer shall be minimum 130 VA.
 - b. Control transformer primary and secondary shall be fused for over current protection.
8. Current Transducer
 - a. Current transducer shall be manufactured by Veris Industries.
 - b. Current transducer shall have adjustable set point from 1-135A with 200 ms or less response time.
9. Fail Conditions
 - a. When a grinder jam obstruction occurs, the controller shall stop the grinder and reverse the rotation to clear the obstruction. If the obstruction is cleared, the controller shall return the grinder to normal operation. If three (3) reverses occur within a 30 second interval, the controller shall stop the grinder motor in a jam condition and activate the grinder FAIL indicator and relay.
 - b. When a power failure occurs while the grinder is operating, the grinder will resume operation once power is restored.
 - c. When a power failure occurs while the grinder is in a fail condition, once power is restored the fail indicator shall reactivate and remain until reset.
 - d. Reset of the grinder shall be accomplished from the controller only.

2.6 SOURCE QUALITY CONTROL

- A. The machine shall be factory assembled and tested before shipping.

2.7 SPARE PARTS

- A. Provide additional 30005-0008 Grinder with 5hp immersible motor and reducer.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Equipment shall be supervised and installed by manufacturer and/or an authorized manufacturer representative.

3.2 INSTALLATION

- A. Shall be installed in accordance with supplier's installation instructions, and in accordance with all OSHA, local, state, and federal codes and regulations.

3.3 FIELD QUALITY CONTROL

If required, an authorized manufacturer representative shall be provided to assist in the installation and startup of the unit, and to provide training to equipment operator personnel. A field training course shall be provided for operation and supervisory staff members. Field instruction shall cover items for successful operation contained in the operation & maintenance manuals.

END OF SECTION 333245

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Vigo County Security Center

Pre-Bid Meeting Minutes

September 19, 2019



I. Introduction of Project Team Personnel – MP introduced team and project

- A. Owner- Vigo County
- B. Architect – DLZ Indiana, LLC. – Eric Ratts
- C. Construction Manager – Garmong Construction Services
 - Mike Peterson, Project Manager MPeterson@garmong.net

II. Bidding Information – MP noted the following items:

- A. Project Overview: New construction of a Jail, approximately 139,000sf, 504 beds, Sheriff's offices and supporting spaces
- B. Bids are due October 3, 2019 at 2:00pm to the County Auditor. A public bid opening will follow in the County Council Chambers.
- C. All bids shall be for a complete bid package.
- D. Questions are due by the end of day, September 23, 2019
- E. The last addendum is anticipated for September 26, 2019 – MP mentioned the following: Addendum 1 was issued 9/12/19. Addendum 2 should be available on plan room by 9/20/19. The final addendum will be issued 9/26/19 and will include these meeting minutes.
- F. Bidding documents are available at Garmong plan room and Rapid Reproductions.
- G. All questions/RFI's should be addressed to Mike Peterson or Kent Ferrari.

III. Scope of Work

- A. Project Manuals & Drawings – DLZ noted that drawing pages with red notes in the bottom right corner of the page are to be printed in color. Failure to do so could result in missed information and/or an inaccurate bid.
- B. Bid Package Breakdown: 011200 Multiple Bid Package Summary – MP noted that vendors who are looking to supply products should submit bids to prime bidders for each bid package.
 - Bid Packages 1 General Trades
 - Bid Package 2 Asphalt Paving
 - Bid Package 3 Masonry
 - Bid Package 4 Structural Steel
 - Bid Package 5 Roofing
 - Bid Package 6 Metal Studs, Drywall & Acoustical Ceilings
 - Bid Package 7 Painting
 - Bid Package 8 Flooring & Ceramic
 - Bid Package 9 Fire Protection
 - Bid Package 10 Mechanical and Plumbing
 - Bid Package 11 Electrical Systems
 - Bid Package 12 Kitchen Equipment
 - Bid Package 13 Detention Equipment

IV. Construction Matters: - MP noted the following:

- A. Laydown and office area to be established. Each trade will be responsible for their power and telecommunications requirements.
- B. Dumpsters are by the Construction Manager/Owner
- C. Each contractor is responsible for their own hoisting and material transportation.
- D. Material testing by Construction Manager/Owner – MP noted that coordination will be required by each prime bidder.

- E. Construction Manager/Owner will provide local building permits.
- F. Progress cleaning to be provided by contractor performing work on a daily basis. In addition, composite cleanup crews will be utilized as described in specification section 011200. – MP noted that it is still the contractor's responsibility to clean up their work. The composite cleanup crews are only there for additional maintenance support.

V. Safety and Environmental Compliance – MP noted the following items:

- A. All OSHA requirements will be followed and met by all contractors.
- B. Hardhats, eye protection, safety shoes and hi-viz apparel are required by all personnel for the duration of the project.
- C. Periodic reviews of the project site will be made to ensure all safety requirements are being met. Contractors will be required to take immediate corrective action on any deficiencies noted.

VI. Schedule

- A. Anticipate construction start December 2, 2019 with a completion date of December 2, 2021.
- B. Reference Project Manual Specification Section 0113200 for milestone dates
- C. Construction phasing/flow of work - review
- D. Upon contract award, Construction Manager will meet with contractors to develop a detailed project schedule. Each successful bidder will provide a detailed schedule for their work to be integrated into the overall schedule by the Construction Manager. – MP noted that the final schedule will be created to maintain the 24 month timeline from start to finish.

VII. Administrative – MP noted the following items:

- A. Contract agreement to be signed un-amended. See specification section 005214
- B. Review insurance requirements and make provisions to meet all requirements.
- C. Materials supplied for this project are exempt from Indiana State sales tax.
- D. Project documentation will be done electronically utilizing Procore. This includes document control, submittals and RFI's. Successful bidders will also be required to utilize this program.

VIII. Project Review

- A. Access Road: Installation of the main access road will be required immediately upon release.
- B. Installation of site drainage structures and piping
- C. Maintain road throughout construction for construction traffic – MP noted this is a part of the general trades bid package. This will include clearing snow off the road when necessary.
- D. Installation of precast concrete and planks must be coordinated the Steel and Masonry Bid Packages. – MP noted that multiple mobilizations will be required for this project due to its complexity.
- E. Access for installation of prefabricated steel cells shall be provided by BP No. 1. This may include precast leave-outs for the dual level cells to be rolled into place. – MP noted the need for knockout panels on the exterior and interior walls and the cells require a dry structure before they can be installed.
- F. Off-Site sanitary sewer: all roadwork, site remediation, plantings, grading, etc. shall be included by BP #10 Mechanical & Plumbing

IX. Questions

- A. Review any questions – See bidder questions and answers from Mike Peterson below:
 - i. What bid package carries utilities?
 - 1. Each bid package is responsible for utilities assigned to that scope of work.
 - ii. Is it possible to leave deadmen for precast in place?
 - 1. This may be allowed if they do not interfere with new construction.
 - iii. Where are the wage agreements located?
 - 1. As this is not a federally funded project, no wage rate mandates are applicable.
 - iv. Where will the precast knockouts be located?

1. This is not noted on the drawings. It will be the responsibility of the bidder to plan accordingly and configure this into their bid. It was noted that the knockouts should not interfere with utilities.
- v. Who takes care of the perimeter fencing?
 1. The perimeter fencing is to be completed by the general trade's contractor. It was noted that there is an alternate included for this scope.
- vi. Is the owner requiring minority business participation?
 1. MP noted that the answer can be found in the specifications.
- vii. Details 3/S551 and 6/S551 indicates steel angle fastened to the embeds in precast panels. Are the steel angles by the precast contractor?
 1. The precast contractor is to provide and install all embeds per Bid Package No. 01.
- viii. Is the communications contractor to provide communications equipment or will the owner?
 1. Contractor is to provide all items specified. This is to be further clarified.
- ix. Can a responsibility matrix be created for clarification on scopes of work?
 1. MP noted that the fire alarm system is to be provided by the electrician. MP to evaluate if further clarification is required.
- x. Are vendor/ subcontractor listings required?
 1. This information can be found in the specifications.

Bid Question Log

Project Name: Vigo County Security Center

Date: September 26, 2019

= Items in Addendum - Closed Item



Item No.	Item Description	Received From	Date Received	Date To DLZ	Response Date	Response
01	Watermain Location: Drawings SD 601, 602 & 603 indicate the water main to be installed under the new roadway. As this road is the only access to the site, can the water main be relocated outside the roadbed so the construction entrance can be installed?	GCS	9/6/2019	9/6/2019	9/12/2019	Doyle - watermain location is being coordinated with the utility and will be revised in a future addendum.
02	Watermain: Per IAW requirements as we understand them, the water pit should be located at the property line where the watermain is tapped. From this location, the domestic & fire lines extended to the building/site. Please advise if the currently configured mains should be revised to meet IAW standards.	GCS	9/6/2019	9/6/2019	9/12/2019	Doyle - Answer to be provided on 9/10/19
03	IN room C1047, a fume hood is shown. Is this contractor provided and installed? If so, please provide specifications for this work.	Harry Kloeppel & Assoc.	9/5/2019	9/6/2019		Hauge - Specifications will be issued in future addendum
04	In Interlock D1001A, D1001B, D1002A, D1002B, E1002A, E1002B, E1001A & E1001B, a acoustical ceiling is shown below the gypsum board ceiling. The acoustical ceiling type is not specified. Please specify the acoustical ceiling type in these areas.	General Interiors	9/9/2019	9/9/2019	9/12/2019	Gray - Ceiling type will be APC-1 at 13'-4" a.a.f. Drawing will be revised and reissued in addendum #1.
05	Please provide additional information related to Alternate #5 Square D Electrical Panels? Is this just for panelboards listed in specifications section 262416, or will it be related for an entire Squared D gear package, which would include 262313 – Paralleling LV Switchgear, 26213- Switchboards, 262500 enclosed bis assemblies, etc. 99% of projects we bid the panels and distribution gear, disconnects are quoted in a package, which does not break out the panelboards? I assume this alternate will only be filled out if the Squared D package is not low?	Sycamore Engineering	9/10/2019	9/10/2019		Willey - alterante is for panelboards only. bidding question to be handled by Garmong.
06	On Alternate #6 – Please confirm this alternate will only be filled out if the Honeywell Gamewell System is not low?	Sycamore Engineering	9/10/2019	9/10/2019		Willey - bidding question to be handled by Garmong.
07	Can Spec Section 098410 Fixed Sound Absorbing Panels be moved to BP #6?	General Interiors	9/10/2019	9/10/2019		Garmong to respond to this item in addendum
08	Spec section 31 64 00 paragraph 1.8.C. - Revise qualifications for Engineer to be licensed in the State of Indiana?	GCS	9/11/2019	9/11/2019	9/12/2019	Rednour - Spec section 31 64 00 will be revised in addendum #01.
09	Spec Section 31 64 00 states the design bearing pressure is 4,000 psf whereas the drawings state 5,000 psf. Can you please confirm the correct bearing pressure?	Subsurface Constructors	9/11/2019	9/11/2019	9/12/2019	Rednour - The 5000 psf bearing pressure stated on S-001 is correct. Spec Section 31 64 00 will be revised in addendum #01.
10	The drawings show some thickened slabs. It is unclear whether ground improvement is required for that portion of the structure. Is ground improvement required for the thickened slabs? If so, can you please provide the required bearing pressure?	Subsurface Constructors	9/11/2019	9/11/2019	9/12/2019	Rednour - Details 10 through 13 on page S-530 give depth of overexcavation requirements for thickened slabs.
11	The drawings show generator foundation pads without much other information. Will these foundation pads require ground improvement? If so, we will need to know the pad dimensions and required bearing pressure.	Subsurface Constructors	9/11/2019	9/11/2019	9/12/2019	Rednour - Ground improvement is not required for generator foundation pads.
12	On drawing A-070, the Security Plan Legend indicates both Grade 1 & Grade 2 walls as "Red". Should Grade 2 walls be specified by "Blue"	GCS	9/11/2019	9/11/2019	9/12/2019	Gray - Correct, the Grade 2 walls are blue. Sheet will be reissued in addenda #1
13	The 114000 specifications are missing items no.'s 43-46 and 51-57. Please provide updated specs for these items	Great Lakes	9/11/2019	9/11/2019		Hague - Included in Addendum 2
14	Please provide specifications for the grass pavers required for the project.	S&G	9/13/2019	9/16/2019		Hirsch - Basis of Design Product: GrassPave2. Available through: Invisible Structures, Inc., 1600 Jackson St. Suite 310 ; Golden, CO 80401; Toll Free Tel: 800-233-1510; Tel: 303-233-8383; Email: request info (sales@invisiblestructures.com); Web: www.invisiblestructures.com. or approved equal.
15	Section 271500 – Communications Horizontal Cabling. Shown in Addendum No. 1 as Item No. 48, to be deleted without replacement. There is a section included in the attachment in regard to this specification, please advise.	GCS	9/16/2019	9/16/2019		Willey - Section was added not deleted, will clarify in next Addenda

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16	Addendum No. 1: Section 274133 – Master Antenna Television System. No changes shown in addendum, but a section is included in the addendum in regard to this specification, please advise.	GCS	9/16/2019	9/16/2019		Willey - Section was added, will clarify in next Addenda
17	Addendum No. 1: Section 283100 – Access Control System. No changes shown in addendum, but a section is included in the addendum in regard to this specification, please advise	GCS	9/16/2019	9/16/2019		Tomlinson - Section was not included in original bid document issuance. Provide all material and labor as required for section.
18	Addendum No. 1: Section 282300 – IP Video Communication System. No changes shown in addendum, but a section is included in the addendum in regard to this specification, please advise	GCS	9/16/2019	9/16/2019		Tomlinson - Section was not included in original bid document issuance. Provide all material and labor as required for section.
19	TOC: Revise 007226 Genereal Conditions to Read 007216 General Conditions	Hannig	9/12/2019	9/16/2019		Hague Garmong Addendum 2
20	TOC: Delete 014551 Testing Facilites and Controls from TOC; Add 014510 Testing Laboratory Services to the TOC	Hannig	9/12/2019	9/16/2019		Hague Addendum 2
21	TOC: Add 017329 Cutting and Patching to the TOC	Hannig	9/12/2019	9/16/2019		Hague Addendum 2
22	TOC calls for Specification Section 230523 Globe Valves for HVAC Piping; Spec Section is 230523.11. Please advise on correct Spec No.	Hannig	9/12/2019	9/16/2019		Apling Addendum 2 Hague
23	TOC calls for Specification Section 230548 Vibration Controls for HVAC Piping; Spec Section is 230548.13	Hannig	9/12/2019	9/16/2019		Apling Addendum 2 Hague
24	TOC: Add specification section 333245 Horizontal Shaft Communter to TOC's	GCS	9/16/2019	9/17/2019		
25	Are electrical boxes to be cast into precast wall panels	coreslab	9/17/2019	9/17/2019		Gray - Yes, conduits and boxes should in cast into the panel.
26	Section 3.2 Equipment calls for “an electric Vibrator capable of providing at least 80HP of rated energy Whereas 3.3B indicates “all stone column elements shall be pre-augured using mechanical drilling” and	Geopier	9/17/2019	9/17/2019		Rednour - Specification updated in Addendum #02.
27	Section 3.4 Installation, section A calls for “Special high energy impact densification apparatus shall be used to densify the Aggregate Columns. Installation without pre-augering shall not be allowed.” Normally stone columns do not use pre-auguring, whereas Geopier Rammed Aggregate piers do use pre-augering.	Geopier	9/17/2019	9/17/2019		Rednour - Specification updated in Addendum #02.
28	Section 3.4C – “the bottom of the excavation shall be densified prior to the placement of the aggregate” – this very seldom happens We normally use a layer of stone such as ASTM No 57 (or Indiana #2 stone) in the bottom of our drilled holes.	Geopier	9/17/2019	9/17/2019		Rednour - Specification updated in Addendum #02.
29	Section 3.4D - “Densification shall be performed using a beveled tamper.” – this is in conflict with Section 3.2 noted above.	Geopier	9/17/2019	9/17/2019		Rednour - Specification updated in Addendum #02.
30	Section 3.5C Bottom Stabilization Verification Test – this is a common test used in Geopier Rammed Aggregate Piers and not Stone Columns	Geopier	9/17/2019	9/17/2019		Rednour - Specification updated in Addendum #02.
31	Section 3.5D Dynamic Cone Penetrometer Test - this is a common test used in Geopier Rammed Aggregate Piers and not Stone Columns	Geopier	9/17/2019	9/17/2019		Rednour - Specification updated in Addendum #02.
32	Is exterior sheathing all plywood? I do not see where it call out what type it is. Specs calls out for gypsum sheathing and plywood. Please confirm.	General Interiors	9/17/2019	9/17/2019		Wink - Plywood sheathing is noted as plywood in details. Sheathing is noted in wall sections. Specification 061600 was revised in Addendum #02 for gyp sheathing to be 5/8" in liue of 1/2".
33	In Addendum No. 1 spec section 034100 Precast Structral Concrete, various items including f. l, j, l, y z, aa and others, specify to revise the sentence or added this sentence, but no verbage is provided. Please provide a revised specification for this work.	GCS	9/17/2019	9/17/2019		Hague Revised in Addendum 2
34	In Addendum No. 1 spec section 084523 Fiberglass Sandwich Panel Assemblies, it notes the aluminum finish and warranty are to be changed. No revision clarification is provided. Please specify this revision.	GCS	9/17/2019	9/17/2019		Answered in Addendum 3 reissued this spec section.
35	The mezzanine specifications call for galvanized grating for the mezzanine and stairs in the Day Rooms. The galvanizing leaves a rough surface that affects inmates in socked feet. Please advise if this should be painted?	Pauley Jail	9/17/2019	9/18/2019		Gray - Stair treads and walkways in the housing areas shall be galvanized per specifications.
36	Detail 11 on SD-801 - What material is the 2" compacted aggregate surface course?	S&G	9/18/2019	9/18/2019	9/25/2019	Surface course will be INDOT No. 73 and added to Specification section 312000

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37	On the finish schedule (A620). What abbreviation designates the resinous flooring?	Santarossa	9/18/2019	9/18/2019		Gray - RS - Resinous Flooring. RS shall replace all floor finishes notes as EP. Sheet A-620 will reissued - Addenda #3
38	The resinous flooring spec(096723-p3 &4) has a system 1 and a system 2. We will need to know which goes where.	Santarossa	9/18/2019	9/18/2019		Gray - Resinous Flooring System #1 shall be used as typical. Resinous Flooring System #2 shall be used in front of the showers
39	The Terrazzo spec. (096623 p-9) mentions sealing precast terrazzo stair treads. I do not see any. Are there terrazzo treads or terrazzo base anywhere?	Santarossa	9/18/2019	9/18/2019		Added to addendum 3 deleted all reference to terrazzo base and stair.
40	The erosion control drawings do not appear to indicate silt fence installation around the site. Is this required?	S&G	9/17/2019	9/18/2019	9/25/2019	No silt fence required around the site however it is required along portions of the road construction area
41	The camera Type 12, Axis model P3707-PE, has been discontinued. Please advise what we need to replace that camera with. The P3717-PLE is the recommended replacement (Camera Type 4	Stanley Convegent	9/18/2019	9/18/2019	9/25/2019	Tomlinson - Provide P3717-PLE in lieu of discontinued P3707-PE.
42	On drawing S-103-B, between column lines L & H and approximately 12.7 & 14, there is note indicating "8PC". However, the area is not hatched to indicate precast planking. Please confirm no planking is required in this area.	Hannig	9/20/2019	9/23/2019	9/25/2019	Van Luchene - Addressed in Addenda 3
43	On print M500 (2). It shows in the pic 16ga welded duct for the smoke exhaust fans. Then in the spec 233113 -15 D1 Exhaust duct is called out to be 2" static- class B (this would be like 22ga). Does the smoke exhaust ducts need to be 16ga welded?	Poynter Sheet Metal	9/20/2019	9/23/2019		16 gauge welded duct requirement shown in detail will be removed. It is not applicable to smoke exhaust fan ductwork.
44	In spec section 221313 Facility Sewers, Backwater Valves are called for. Please profile a detail on how the backwater valves are to be installed.	Freitag, Inc.	9/23/2019	9/23/2019		The specification section will be modified in addendum #3 to eliminate the backwater valves.
45	For underground plumbing piping, Mechanical Room C1053, would this area be considered in the administration and public areas?	Sycamore Engineering	9/19/2019	9/19/2019		Sanitary piping from Mechanical C1053 can be considered in the Administration and Public areas as it applies to the underground plumbing piping.
46	Is there an integral trap in the shower in the premanufactured cell? If not will a trap be required, the riser diagram does not show one.	Sycamore Engineering	9/19/2019	9/19/2019	9/20/2019	The pre-fabricated cells with non-ADA showers type SH-1 consist of a raised shower pan with an integral p-trap. The ADA showers do require a p-trap as shown on the riser diagrams. Note there are SH-2 type non-ADA showers in Intake/Booking area that are part of pre-fabricated cells that do not have raised pans. These are shown with a floor drain and trap on the isometrics.
47	On dwg S-001, paragraph 6 Structural and Miscellaneous Steel, note K; calls out an lintel angle 9x4x3/8". Per suppliers, this size is not a current size. Please advise if this is the correct size.	Benchmark	9/20/2019	9/23/2019	9/25/2019	Van Luchene - Addressed in Addenda 3 - loose lintel to be a bent plate of the indicated dimensions
48	Per Drawing E-001, General Note LL, RACK MOUNTED HEAD-END EQUIPMENT (I.E. SWITCHES, PATCH CABLES, UPSs, SURGE PROTECTORS FOR MAIN DISTRIBUTION FRAME (MDF) AND INTERMEDIATE DISTRIBUTION FRAMES SHALL BE FURNISHED AND INSTALLED BY CONTRACTOR. Per Drawing E-801, Detail 5; Note 1, RACK HEAD-END ELECTRONIC EQUIPMENT (I.E. ROUTER, POE SWITCHES, POE INJECTORS) SHALL BE FURNISHED AND INSTALLED BY OWNER. Please clarify what the contractor is responsible for in regards to Head-End electronic equipment for the MDF/IDF(s)?	C-Cat	9/19/2019	9/20/2019		Willey - Clarifiaction added to drawings, reference detail #5 on Drawing E-801.
49	Is the contractor responsible to furnish and install the Wireless Access Points and associated PoE switches?	C-Cat	9/19/2019	9/20/2019		Willey - Clarifiaction added to drawings, reference detail #5 on Drawing E-801.
50	Can you please clarify what is to be installed for the HD outlets and the TV outlets? There are some locations that don't have a TV outlet associated with the HD outlet, as well as some HD outlets with no AFF measurements. (I.E. Drawing E-401-B, Rooms B1096, B1064). There are rooms that have (2) HD outlets associated with a TV outlet as well (I.E. Room B1096 and B1037). I can't find any detail pages that show the connection between the HD outlets and the TV outlets.	C-Cat	9/19/2019	9/20/2019		Willey - HD Outlets only require a pre-terminated HDMI cable in raceway between two boxes. Boxes are typically shown in same room. There are a few locations, Room B1096 as an example, where the boxes are in different rooms. In Room B1096 those boxes correspond to "HD" boxes in the Medical and Female Dayrooms. "HD" boxes are to be installed at +16" AFF unless otherwise noted per Drawing E-001.
51	It is noted that thin brick is to be cast onto the precast panels. Please provide a thin brick specification for embedded thin brick into specification section 034100 as to clarify the thin brick manufacturer wanted, size of thin brick wanted (modular?) and color and finish wanted on the thin brick to be furnished and cast in by the precaster? Please see sample specification for thin brick attached.	coreslab	9/19/2019	9/23/2019		Gray - See specitication SECTION 042113 – BRICK MASONRY
52	The concrete specifications are calling for a .35 w/c ratio for interior slabs. Please have the engineer reiew this spec as this will be impossible to achieve.	IMI	9/18/2019	9/23/2019		Van Luchene - the 0.35 w/c ratio is NOT for slabs but for the topping on the HC precast slabs. Slabs have a w/c ratio of 0.42.

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53	We are directed to use a # 57 aggregate (Indiana # 8) as drainage fill under the building slab. This is a clean gravel or stone and will not compact. Is this what you want ? Please advise if another material is wanted?	S&G	9/19/2019	9/23/2019		Van Luchene - Addressed in Addenda 3 - drainage course to be INDOT NO. 53
54	There is a typical slab detail (S-530, detail 4) on the detail pages for foundations which depicts a geotextile under the drainage fill and a vapor barrier over the drainage fill. Does this detail requirement extend to the entire floor slab area ?	S&G	9/19/2019	9/23/2019	9/25/2019	Van Luchene - Addressed in Addenda 3 - with the use of INDOT No. 53 for drainage course, geotextile is no longer required. Detail applies to SOG under entire buiding footprint.
55	On Drawing S101-B, there are hash marks on portions of the floor slabs which are considered "High Density Storage Areas" The detail referenced is S-531 - 15. This detail shows a thicken slab with two foot undercut. Is this undercut to be included in the entire area with hash marks on S 101-B or just refer to the thicken slab in this area	S&G	9/19/2019	9/23/2019	9/25/2019	Van Luchene - over excavation is only required under the thickened section at the rails per the referenced detail.
56	The aggregate base under the roads / lots can be a # 53 stone or # 53 gravel according to the spec. book. Even though # 53 Gravel will be more economical, it will not hold up as well in the winter as 53 stone. Knowing this, do we still have our choice as to what to use	S&G	9/19/2019	9/23/2019	9/25/2019	The base can be either as long as the product is crushed, angular and can be compacted to required density.
57	Section 123553.13 metal casework is included in the project manual but no casework is called out on the drawing as being metal. The model number for elevations 1 and 2/a455 appear to be different than the rest of the casework. Are these the metal cabinets?	Kloppell	9/23/2019	9/24/2019		Wink - Yes, these are the metal casework. Will be clarified in Addendum 3.
58	Roof system warranty is to be thirty (30) years which would require the use of 80 mil membrane, yet specifications call for 60 mil membrane. Should 80 mil membrane be utilized to obtain 30 year warranty ?	Insley	9/23/2019	9/24/2019		Gray - Manufacturer is responsible for providing a roof system with a 30 year warranty. If it requires a thicker membrane or other modifications then the manufacturer is responsible to provide the changes as necessary.
59	A substrate board is included in roof make-up summary, but is not shown on drawings or identified in specifications. A substrate board would need to be installed for vapor barrier if wanted. Are substrate board and vapor barrier to be included in roof assembly and if so can you provide types	Insley	9/23/2019	9/24/2019		Revised in Addendum 3 deleted substrate and added another non-asphaltic vapor barrier to be included in roof assembly.
60	There is a note in the finish schedule of SC1, SC2 and PFH. I don't see an spec section for those . Not trying to read more than there is ..I suspect the stains are just the typical stains (clear and clored as it applies) but is the PFH (hardner something done by the mason?	SDR	9/23/2019	9/24/2019		SC-1 is the penetrating liquid floor treatment. SC-2 is a stained concrete, this specification section was added in Addendum 3. PFH will be eliminated since it is the same as SC-1.
61	The shower coating that get a resinous coating I assume is the showers that are the ones not in the cells ...used in rooms like B1120, C1024.....	SDR	9/23/2019	9/24/2019		Gray - Shower coatings are required in all non cell showers
62	The finish schedule references epoxy floors as "EP". The spec section 096723 references two different product (RF1 and RF2) ...which are used where?	SDR	9/23/2019	9/24/2019		Gray - RS - Resinous Flooring. RS shall replace all floor finishes notes as EP. Resinous Flooring System #1 shall be used as typical. Resinous Flooring System #2 shall be used in front of the showers. Sheet A-620 will reissued - Addenda #3
63	Need detail for "gas tight hoods" on the storm catch basins. is depicted on Drawing SD-807, detail 5 (Catch basin hood detail) We have installed these in the past, but they were made out of fiberglass and they were not "gas tight" Not sure how you allow water to flow, but still have a gas tight situation.	G&S	9/23/2019	9/24/2019		Doyle - "Gas Tght" refers to the joint between the hood and the catch basin wall.
64	Will type 1 cement be allowed for building concrete	NIC	9/23/2019	9/23/2019	9/25/2019	Van Luchene - Yes - Addressed in addenda 3
65	will pea gravel 3/8" be required for topping mix?	NIC	9/23/2019	9/23/2019	9/25/2019	Van Luchene - Yes since concrete thickness is only 2" course aggregate size will need to be reduced per ACI 301 requiremetns
66	will HRWR be required for the topping slab?	NIC	9/23/2019	9/23/2019	9/25/2019	Van Luchene - yes, see spec 033000.2.8.C.3
67	For underground plumbing piping, Mechanical Room C1053, would this area be considered in the administration and public areas?					Apling - Sanitary piping from Mechanical C1053 can be considered in the Administration and Public area as it applies to underground plumbing piping.
68	Is there an integral trap in the shower in the premanufactured cell? If not, will a trap be required, the riser diagram does not show one.					Apling - The pre-fabricated cells with non-ADA showers type SH-1 consist of a raised shower pan with an integral p-trap. The ADA showers do require a p-trap as shown on the riser diagrams. Note there is an SH-2 associated with pre-fabricated cells that is non-ADA and does not have a pan. These fixtures are shown with a floor drain and p-trap on the isometric.

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69	Plumbing Fixture Schedule shows 'DT-1'-Detox Toilet, yet none are depicted on plumbing plans, should the padded cells have Detox Toilets as is typically the case?					Apling - Answer: Detox Toilets (DT-1) are indicated on the P-100 series drawings at locations where they are required, including the padded cells. They are also indicated on the plumbing isometrics.
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