ADDENDUM #1

TO THE:

PLANS AND SPECIFICATIONS FOR:

PROJECT	BID PACKAGE 2 - POST OAK EARLY LEARNING CENTER 3570 ODONNELL COURT, COLUMBUS, OHIO
OWNER	COLUMBUS METROPOLITAN HOUSING AUTHORITY
DATE	JANUARY 29, 2021
ARCHITECT	MOODY NOLAN, INC.

This addendum contains changes to the requirements of the bidding Documents, Project Manual and Construction Drawings which have been issued to date. Such changes are to be incorporated into the Construction Documents and shall apply to the work in the same meaning and force as if they had been included in the original documents. Where ever this Addendum modifies a portion of a paragraph of the Project Manual or a portion of any Drawing, the remainder of the paragraph or Drawing shall remain in force.

SPECIFICATIONS:

A. General: Specifications have been revised as indicated in bold or strikeouts.
B. See attached Advanced Engineering Consultants (AEC) Addendum #1 Attachment.

DRAWINGS:

GENERAL:

1. Sheet G000a – COVER SHEET – VOLUME 1
    a. REVISED sheet to add signature lines.
2. Sheet G001 – DRAWING INDEX / CODE SUMMARY
    a. REVISED Project Summary as clouded.
    b. Drawing Index – Volume 1 to add Current Revision Date column.

STRUCTURAL:

1. Sheet S100 – FOUNDATION PLAN
    a. REVISED drawing at entry ramp to see Architectural for layout dimensions.

ARCHITECTURAL:

1. Sheet A101 – FLOOR PLAN
    a. REVISED drawing coded notes to add a Knox Box at the entry and information and callouts for new Detail 12/A810 for the main entry ramp and Detail 12/A810 for the Janitor Room.

2. Sheet A810 – ENLARGED PLANS
    a. REVISED sheet to add Details 11, 12 & 13. Detail 13/A810 additional accessories have been added in the Janitor Rm.
3. Sheet A820 – INTERIOR ELEVATIONS
    a. REVISED Equipment Notes for washers & dryers to be ADA compliant.
4. Sheet A821 – INTERIOR ELEVATIONS
    a. REVISED Equipment Notes and Details 19 & 23 for ADA compliance in Laundry room.
5. Sheet A822 – INTERIOR ELEVATIONS
    a. REVISED Equipment Notes for washers & dryers to be ADA compliant.

MEP:

1. See attached Advanced Engineering Consultants (AEC) Addendum #1 Attachment.

LANDSCAPE:

1. Sheet L1.01 LAYOUT PLAN – See attached revised sheet.
2. Sheet L3.01 SITE DETAILS – See attached revised sheet.

CIVIL/SITE:

1. C502 DETAILS - See attached revised sheet.
2. CC-03 - CC-STORM PLAN - See attached revised sheet.
3. CC-08 - CC-STORM PLAN - See attached revised sheet.

OTHER:

1. Pre-Bid Meeting Minutes with notes.
2. Pre-Bid Sign in Sheet
3. HUD 221 Loan Requirements for General Contractor

(END OF ADDENDUM)

ATTACHMENTS

A. Specifications: 01 45 33, 03 01 30, 04 00 00, 07 41 13, 07 92 00, 08 41 13, 08 43 14, 08 81 00, 09 21 16, 09 30 00, 09 51 13, 10 26 00, 10 28 13, 10 44 00, 12 33 55
   All Specifications listed under Advanced Engineering Consultants (AEC) Addendum #1 Attachment.
B. Drawings: G000a, G001, S100, A101, A810, A820, A821, A822, L1.01, L3.01, CC-03, CC-08, All sheets listed under MEP Addendum attachment.
C. Other: Pre-bid Meeting Minutes, Advanced Engineering Consultants (AEC) Addendum #1 Attachment, Pre-Bid Sign in Sheet, HUD 221 Loan Requirements for General Contractor

ADVANCED ENGINEERING CONSULTANTS

MECHANICAL ELECTRICAL PLUMBING FIRE PROTECTION

ADDENDUM NO. 1

Date 1/28/2021

Subject: CMHA Post Oak Early Learning Center
Columbus, OH
AEC Project No. 20-030-09

TO ALL DOCUMENT HOLDERS:

Enclosed herewith is a copy of Addendum No. 1 covering subject referenced above. Please retain this with your Documents. Please reference the enclosed Addendum #1 and review it carefully with your bid package. This letter and Addendum #1 have been forwarded to all contractors holding the plans and specifications.

SPECIFICATIONS:

PART 1 – SPECIFICATIONS

Bid Package 2 –

A. 22 07 19 – Delete “approved equal” from paragraph 2.1.E.1
    a. Add manufacturers Knauf and Manson to paragraph 2.1.E.1.
B. 22 13 23 – Delete “or equal” from paragraph 2.1.B.
    a. Add manufacturer Norwalk Concrete Industries, Norwalk OH to paragraph 2.1.B.
C. 26 00 10 – Delete paragraphs 1.1.13, 1.3.C.11 and 2.2.
D. 26 05 33 – Delete paragraphs 2.3.A.7. and 2.3.F.2.
E. 26 05 33 – Delete “or equal” from paragraphs 2.3.D.2., 2.3.F.1, 2.3.G.1, 2.3.H.1.
F. Delete the following Specification Sections:
    a. 27 00 01 General Requirements for Communications
    b. 27 05 02 Basic Materials and Methods for Communications
    c. 27 05 26 Grounding and Bonding for Communications
    d. 27 05 28 Pathways for Communications
    e. 27 05 33 Identifications for Communications
    f. 27 11 16 Communications Cabinets, Racks, Frames and Enclosures
    g. 27 11 23 Communications Cable Management and Ladder Rack
    h. 27 11 26 Communications Rack Mounted Power Protection and Power Strips
    i. 28 13 00 Access Control
    j. 28 13 53 Network (IP) Intercom System
    k. 28 20 00 Video Surveillance
    l. 28 31 11 Digital, Addressable Fire-Alarm System

Bid Package 1 - Add the following Specification Sections:

A. 27 00 01 General Requirements for Communications

B. 27 05 02 Basic Materials and Methods for Communications
C. 27 05 26 Grounding and Bonding for Communications
D. 27 05 28 Pathways for Communications
E. 27 05 33 Identifications for Communications
F. 27 11 00 Structured Cabling System
G. 27 11 16 Communications Cabinets, Racks, Frames and Enclosures
H. 27 11 23 Communications Cable Management and Ladder Rack
I. 27 11 26 Communications Rack Mounted Power Protection and Power Strips
J. 28 13 00 Access Control
K. 28 13 53 Network (IP) Intercom System
L. 28 20 00 Video Surveillance
M. 28 31 11 Digital, Addressable Fire-Alarm System

PART 2 – DRAWING REVISIONS

Bid Package 1 (Technology) -

A. Drawings added: Cover, T-001, T-002, T-101, T-501 and T-502.

Bid Package 2 –

A. DRAWING P-100 – UNDERFLOOR PLAN – PLUMBING
    1. Revised gas service entrance.
    2. Revised floor drain layout in Kitchen 134.

B. DRAWING P-101 – FLOOR PLAN-PLUMBING
    1. Revised Coded Note 11.
    2. Added Coded Note 13.
    3. Revised natural gas piping layout.

C. DRAWING P-401 – ENLARGED PLANS – PLUMBING
    1. Revised gas piping layout.
    2. Revised floor drain locations in Kitchen.

D. DRAWING P-601 - SCHEDULES – PLUMBING
    1. Revised flush valve for WC1, WC2, WC3, and UR1.
    2. Revised faucet for sinks S1, S2, and S3.
    3. Revised faucet for lavatory L1.

E. DRAWING M-101 – PLAN
    1. Revised outside air cfm value for Preschool 154, Preschool 150, Supplies 105, Storage 112, Food Prep 113, Food Prep 122, Laundry 132, Storage 131, Water Room 137 and Storage 136.
    2. Revised outside air cfm and exhaust air cfm in Food Prep 151 and Toilet 152.

F. DRAWING M-501 – DETAILS
   1. Revised detail 8 showing smoke detector for F-4 in return duct.

G. DRAWING M-601 – SCHEDULES
   1. Ventilation Schedule - Removed Preschool Rooms 157, 158 and 159 and revised 154 and 153 to reflect the floor plan.
   2. Furnace Cooling Coil and Condensing Unit Schedule – Revised Service value for F-1 and F-2.
   3. Dedicated Outdoor Air Unit Schedule – Added note 6 for manufacturer provided smoke detector.

H. DRAWING E-003 – SITE PLAN – ELECTRICAL
   1. Added power connections to hot box. Added coded note 17.

I. DRAWING E-101 – FLOOR PLAN - LIGHTING
   1. Rooms 104, 106, 111, 115, 120, 124, 143, 150, 154, corridor 101 and 140 – Deleted Daylight sensor (DS) and daylight harvesting function.
   2. Corridor 140 – Circuited luminaire R4 outside of Room 143.
   3. Revised exterior luminaire to R6 in lieu of R4.

J. DRAWING E-201 – FLOOR PLAN – POWER
   1. Provided power connection for door hardware. Added coded note 32.

K. DRAWING E-301 – FLOOR PLAN – SYSTEMS
   1. Deleted this sheet and its entirety from Bid Package 2.

L. DRAWING E-501 – DETAILS - ELECTRICAL
   1. Revised Detail 8.

M. DRAWING E-503 – DETAILS - ELECTRICAL
   1. Delete this sheet and its entirety from Bid Package 2.

N. DRAWING E-601 – SCHEDULES - ELECTRICAL
   1. Revised construction and finish for luminaires R1A, R1B, R2 and R3.
   2. Revised luminaire R4 description.
   3. Added Luminaire R6.
   4. Added detail description for luminaire W3.

O. DRAWING E-602 – SCHEDULES - ELECTRICAL
   1. Circuit hot box heaters to Panel P2.
   2. Switchboard MDP load has been updated.
   3. Revised Switchboard callout in panelboards to MDP in lieu of MSB. Refer to panelboard schedules.

DRAWINGS:

BID PACKAGE 1 – T-000, T-001, T-002, T-101, T-501, T-502
BID PACKAGE 2 - P-100, P-101, P-401, P-601, M-101, M-501, M-601, E-003, E-101-E-201, E-501, E-601 and E-602

Columbus Metropolitan Housing Authority
880 East 11th Avenue
Columbus, Ohio 43211
www.cmhanet.com

PRE-BID MEETING:

Date:	Tuesday, January 26, 2021
Time:	11:0am – 12:00pm
Subject:	Post Oak: Early Learning Center / RAD Renovations – Pre-Bid Meeting
Location:	Post Oak Community Building – 1383 Vida Way, Columbus OH

1. **Project Information / Contact Information**
   a. Owner: Columbus Metropolitan Housing Authority - 880 E. 11th Ave., Columbus, Ohio
      i. Chris Belcastro – Construction Manager – MAIN CONTACT
      cbelcastro@cmhanet.com
      614-421-6077 (office) 614-512-3876 (mobile)
      ii. Mike Wagner – VP Design and Constriction
      mwagner@cmhanet.com
      614-421-6102 (office)
   b. Management Company: Wallick Communities – 6880 Tussing Road, Reynoldsburg, Ohio
      i. Jim Cruz – Maintenance Manager – MAIN CONTACT
      jcruz@wallick.com
      614-595-1107 (mobile)
      ii. Patty Osterman – RAD Specialist
      posterman@wallick.com
      614-612-0645 (mobile)
   c. Architect / Engineer: Moody Nolan / Moody Engineering / Prater MEP / Jezerinac Geers
      i. Anup Janardhanan
      AnupJ@moodynolan.com
      614-280-3220 (office - Direct) 614-461-4664 (office – Main)
      ii. Mark Haker
      mhaker@moodynolan.com
      614-280-3260 (office - Direct)

2. **Pre-Bid Period:**
   a. Pre-Bid Date: Tuesday January 26th, 2021 – 11:00am-12:00pm.
      i. Post Oak Community Building – 1383 Vida Way, Columbus OH
      ii. Site tours at Post Oak community to follow
         1. Any additional site visits may be requested directly through Wallick Communities:
            a. Jim Cruz – 614-595-1107
   b. Last day to submit questions: Tuesday February 23rd, 2021, by 5:00pm.
      i. Submit questions to Chris Belcastro @ CMHA cbelcastro@cmhanet.com and Anup Janardhanan @ Moody Nolan AnupJ@moodynolan.com
   c. Last addendum to be issued: Thursday February 25th, 2021 by 5:00pm.

3. **Bid:**
   a. Bid Date: Thursday March 4th, 2021 @ 11:00am
      i. Bid opening will be held Virtually (via Zoom)

ii. Links to the bid opening will be provided the morning of the bid. All interested bidders are to request link to bid opening prior to 10:00am the day of the bid.

b. Submit sealed bids – **1 original and 1 copy.**
   i. Time stamped prior to 11:00am at the front reception.
      1. Bids are preferred to be mailed.
      2. Can be dropped off day of to the security at the front desk. *This should be done at least 10 minutes prior to 11:00am to ensure bid is received on time.*
   ii. All CMHA Bid forms to be completed.
   iii. TAB ALL SECTIONS
   iv. Bidders are to provide a bid bond equal to 5% of the bid. 100% performance and payment bond to winning contractor.

4. Award/Contract Information:

a. Bids will be reviewed for LOWEST and BEST by Moody Nolan and CMHA.
b. CMHA will take winning bid to March 19th Board.
c. Contract will be issued following Board meeting.
   i. Contractor has 14 days from received approved contract to submit bonds, insurance, workers comp.
   ii. Contract includes HUD contract 5370 – as found in the specifications.
d. NTP will be issued following receipt of contract information.
   i. Contract time is 540 Days from NTP.
e. Liquidated damages are in effect and will be in the sum of $500 per day.
f. This project is a Tax Credit project. Therefore, a Contractor's and Owner's Cost Certification are required at completion of the project. The contractor is required to pay for their cost certification.
   i. CMHA has utilized The Tidwell Group in the past to perform these cost certifications.
g. This project is pursuant with a **HUD 221(D)(4) loan.**
   i. This loan comes with specific requirements and will be addressed in a future addendum.
   ii. *Due to the nature of the timeline of this loan, the project will most likely not start until 6-7 months after the bid opening. The contract documents require the contractor to hold their pricing for 90 days.*
   iii. *HUD 221(D)(4) Loan requirements for the contractor are included in the Addendum #1.*
      1. ***These documents are for reference and DO NOT need to be filled out by the contractor prior to bid. They will be required to be completed and submitted by the low contractor by March 31st, 2021.***
h. This Project will adhere to DAVIS BACON WAGES.
   i. Contractors are required to pay wages as found in the specs.
      1. **These wages are different for the new build / renovation, and the ELC.**
   ii. Additional classifications will be required to be filed by winning contractor after bid award for any trade not listed.
      1. **If a trade is NOT listed, for bidding purposes, please use $30/hour as the labor rate.**

COLUMBUS METROPOLITAN HOUSING AUTHORITY

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www.cmhanet.com

5. **General Information:**
    a. CMHA utilizes the LCP Tracker system for all payroll.
        i. GC will be given a log-in and will be responsible for providing log-in's to their subcontractors.
    b. CMHA/Moody Nolan has already procured all of the General Permits for every building. Contractors are required to pull all trade permits.
        i. The Bid forms currently include a 25,000 allowance for Permitting. This will be removed in Addendum #1 and is a carry over from a previous project. *Revised Bid Section C is included in Addendum #1.*

    c. **SECTION 3 / MBE**
        i. CMHA has a **20% MBE participation GOAL**, and strongly urges contractors to help achieve MBE participation.
        ii. CMHA has a **10% Section 3 participation GOAL and a 20% Section 3 WORKFORCE participation GOAL**, and strongly urges contractors to help achieve this participation.
        iii. Defining MBE / Section 3:
            1. CMHA has contracted with Dotted I Alliance to help assist in MBE and Section 3. Contractors and Sub Contractors may not even realize they are eligible for MBE / Section 3.
            2. CMHA encourages all contractors who are unsure to reach out to CMHA for additional information.

6. **Scope of Work:**
    a. This project will be a RENOVATION of 142 units across 25 buildings within the POST OAK STATION II property, the NEW-BUILD of 2 ADA townhome dwellings containing 8 units *which are following LEED for Homes and all applicable ADA codes*, and the NEW-BUILD of a 14,000 sf Early Learning Center Daycare with an associated technology package (to be provided in Addendum #1). *The ELC will be pursuing LEED.*
        i. All four of the bid packages are expected to be bid as one project.
        ii. Work is expected to take place on all 3 construction types simultaneously.
        iii. Construction is expected to jump around between buildings for the rehab depending on unit availability and relocation of existing residents.
    b. An estimate has been completed for the Residential (rehab and new build) and ELC building.
        i. Residential Rehab: $10,000,000
        ii. Residential New Build: $2,000,000
        iii. ELC: $5,000,000
            1. **TOTAL: $17,000,000**
    c. ****Please review the back of the specs for additional information on colored pictures of the sites.****

7. **Questions?:**
    a. Who is doing the Review of the LEED for ELC, LEED for Homes ADA, and Enterprise Green for the rehab units?
        i. *Moody Nolan has procured SOL to complete this work. The awarded contractor is to coordinate any required inspections etc. with SOL as needed throughout the construction schedule.*

COLUMBUS METROPOLITAN HOUSING AUTHORITY

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b. What items are provided by the owner?
   i. *There aren't any at this moment.*

c. Who takes care of the tap fee's, new services, aid to Construction, etc?
   i. *The Contractor is to take care of the tap fees, new services, and any new aid to construction. CMHA is working with Moody Nolan to determine these costs and will provide this in a future addendum.*

d. **What are the status of the ACM/LBP/Radon Tests?**
   i. *CMHA and Moody Nolan are still waiting for those reports to come back.*

e. **The bid forms show 11:00pm. Its supposed to be 11:00am correct?**
   i. *Correct. The revised Bid Form is attached.*

END OF MEETING MINUTES

COLUMBUS METROPOLITAN HOUSING AUTHORITY

Columbus Metropolitan Housing Authority
880 East 11th Avenue
Columbus, Ohio 43211
www.cmhanet.com

POST OAK: EARLY LEARNING CENTER / RAD RENOVATIONS
PRE-BID MEETING – SIGN-IN SHEET

Project:	Post Oak: ELC / RAD	**Meeting Date:**	1/26/2021
Facilitator:	Mike Wagner	**Place/Room:**	Site

Name	Company	Phone	E-Mail
Chris Belcastro	CMHA	614-512-3876	cbelcastro@cmhanet.com
Mike Wagner	CMHA	614-813-4911	mwagner@cmhanet.com
D.J. Fett	Elford	614-619-6624	djfette elford.com
Aaron Daman	Elford	614-375-0931	adaman@elford.com
MARC GRAF	SETTERLIN	614-643-3031	m.graf@setterlin.com
Bill Watson	WGC	740-404-0731	bwatsonwgc@gmail.com
Ron Buehler	WODA	(614) 230-6753	rbuehler@ wodagroup.com
Ryan Bashent	Commercial works	614-551-3924	rbashent@ commercial-works.com
Michael Rogers	TRI-State Renov.	614-449-0070	tristate43201@ att. net
Randy Kratzer	TRI-State Renov	V	11
Terry Sparks	Fishel Company	614-375-6479	tsparks@ Team Fishel.com
Chris Sandusky	WCI	614-981-4705	Csandusky@ Woda group.com
Patty Hobson	Midstates Recreation	740-641-2525	patty@midstatesrecreation.com
Gavin Lim	AEC	614 282 7031	gavinl@aaecmop.com
SCOTT WELLS	OBERER THOMPSON	937.426.3577	swells@ gdcg.com
Mike EVANS	Prater ENG	614-766-4896	mjevans@praterengr.com
ANUP JAMARDHARAN	MOODY NOLAN	614 461 4884	AnupJ@ moodynolan
MARK HAKER	MOODY NOLAN	614 286-7811	mhaker@ moodynolan.com

GENERAL CONTRACTOR FORMS

Work-sheet #			(d)(4)firm	(d)(4) PILOT
1		50 / 75% Rule of Disclosure Certification	x	x
2		Cert Approving Release of Banking and Credit	x	x
3	**HUD 2328**	Contractor's Cost Breakdown (Cost Estimate Pkg)	x	x
4	**HUD 5372**	Construction Progress Schedule	x	x
5	**HUD 92010**	Equal Employment Opportunity Certification	x	x
6		Financial Statement Certification	x	x
7	**HUD 2530**	Previous Participation Certification	x	x
8		Statement Regarding Other Business Concerns	x	x
9	**HUD 92013-Supp**	Supplement to Application	x	x
10		Work in Progress Statement	x	x

FIFTY/SEVENTY-FIVE PERCENT RULE

RE: RAD Post Oak

5.7 FIFTY/SEVENTY-FIVE PERCENT RULE (the "50/75% Rule")
Whether or not there is an identity-of-interest, no general contractor's fee (general overhead and profit) will be allowed when:

A. More than fifty (50) percent of the contract sum is subcontracted to one subcontractor, material supplier or equipment lessor, OR

B. Seventy-five (75) percent or more of the contract sum is subcontracted to three or less subcontractors, material suppliers and equipment lessors.

Note: If two or more subcontractors have common ownership, they are considered as one subcontractor.

C. How to apply Rule:
   1 The 50 percent rule will apply when division of the amount of the largest subcontract by the contract sum of the construction contract results in more than 50 percent.
   2 The 75 percent rule will apply when division of the sum of the amounts of the three largest subcontracts by the subcontracts by the contract sum of the construction contract results in 75 percent or more.

D. Exceptions to the Rule:
   1 Manufacturers of Industrialized Housing.
   2 Trade items performed by persons on general contractor's payroll.
   3 Supplemental Loan program.
   4 Rehabilitation programs other than substantial rehabilitation.

Note for Cost Certification Stage:

1. Fifty/Seventy-five percent rule check. (See MAP Guide Section 13.17) Use Information from the 'total" and "name of subcontractor or payee" columns of general contractor's cost certification.

If rule applies, disallow general contractor's general overhead and profit. If project uses BSPRA, disallow only general overhead.

GENERAL CONTRACTOR'S CERTIFICATION REGARDING 50/75% RULE

I hereby certify that the General Contractor for the above referenced project will not have any sub-contractors which will meet the 50/75% Rule as stated above.

Certified: TBD

By: _____

[GC Signor Title]

Date: _____

CERTIFICATION APPROVING RELEASE OF BANKING AND CREDIT INFORMATION

RE: RAD Post Oak

To Whom It May Concern:

The Principal consents to the release of any banking and credit information in connection with the mortgage insurance application with respect to the above-referenced project to HUD, the Lender, and any contractors engaged by HUD or the Lender in connection with such application.

The Principal also authorizes the Lender to request credit reports from an independent credit reporting agency and agrees to cooperate fully with said independent agency in regard to this matter. The Lender and HUD are also authorized to verify references and depository institutions supplied by the undersigned.

For the purpose of obtaining financing for the project, the Principal further authorizes the Lender to disclose all financial and other information submitted by the Borrower and others in connection with the project, and hereby releases the Lender, its agents, and employees from liability arising from such disclosures to HUD and to other such persons and entities as the Lender deems necessary or appropriate in connection with the project.

If you make a request, ORIX Real Estate Capital, LLC will provide you with a copy of any such credit report received.

Certified: TBD

By: _____
Name:
Title: [GC Signor Title]
Date: _____

Contractor's and/or Mortgagor's Cost Breakdown

Schedule of Values

U.S. Department of Housing and Urban Development
Office of Housing
Federal Housing Commissioner

OMB No. 2502-0044 (exp. 12/31/2018)

Date	Sponsor
	RAD Post Oak, LLC

Project No.	Building Identification
TBD	**Master - New Construction**

Name of Project	Location
RAD Post Oak	**1383 Vida Way** **Columbus, OH, 43228**

This form represents the Contractor's and/or Mortgagors firm costs and services as a basis for dispersing dollar amounts when insured advances are requested. Detailed instructions for completing this form are included on the reverse side.

Line	Div.	Trade Item	Cost	Trade Description
1	3	Concrete	$ -	
2	4	Masonry	$ -	
3	5	Metals	$ -	
4	6	Rough Carpentry	$ -	
5	6	Finish Carpentry	$ -	
6	7	Waterproofing	$ -	
7	7	Insulation	$ -	
8	7	Roofing	$ -	
9	7	Sheet Metal	$ -	
10	8	Doors	$ -	
11	8	Windows	$ -	
12	8	Glass	$ -	
13	9	Lath and Plaster	$ -	
14	9	Drywall	$ -	
15	9	Tile Work	$ -	
16	9	Acoustical	$ -	
17	9	Wood Flooring	$ -	
18	9	Resilient Flooring	$ -	
19	9	Painting and Decorating	$ -	
20	10	Specialties	$ -	
21	11	Special Equipment	$ -	
22	11	Cabinets	$ -	
23	11	Appliances	$ -	
24	12	Blinds and Shades, Artwork	$ -	
25	12	Carpets	$ -	
26	13	Special Construction	$ -	
27	14	Elevators	$ -	
28	15	Plumbing and Hot Water	$ -	
29	15	Heat and Ventilation	$ -	
30	15	Air Conditioning	$ -	
31	16	Electrical	$ -	
32		**Subtotal (Structures)**	$ -	
33		Accessory Structures	$ -	
34		**Total (Lines 32 and 33)**	$ -	

Line	Div.	Trade Item	Cost	Trade Description
35	2	Earth Work	$ -	
36	2	Site Utilities	$ -	
37	2	Roads and Walks	$ -	
38	2	Site Improvements	$ -	
39	2	Lawns and Planting	$ -	
40	2	Unusual Site Conditions	$ -	Nonresidential and Special Exterior Land Improvement *(costs included in trade item breakdown)* — Offsite Costs *(costs not included in trade item breakdown)*
41		**Total Land Improvements**	$ -	
42		**Total Struct. & Land Imprvts.**	$ -	Description / Est. Cost * — Description / Est. Cost *
43	1	General Requirements	$ -	$ - / None / $ -
44		**Subtotal** *(Lines 42 and 43)*	$ -	$ - / $ -
45		Builder's Overhead	$ -	$ - / $ -
46		Builder's Profit	$ -	**Total $ -** / $ -
47		**Subtotal** *(Lines 44 thru 46)*	$ -	Other Fees / **Total $ -**
48				Description / Cost * — Demolition *(costs not included in trade item breakdown)*
49		Other Fees	$ -	$ -
50		Bond Premium	$ -	$ - / Description / Est. Cost *
51		**Total for All Improvements**	$ -	$ - / None / $ -
52		Builder's Profit Paid by Means Other Than Cash	$ -	$ - / $ -
				$ - / $ -
53		**Total for All Improvements Less Line 52**	$ -	$ - / **Total $ -** / **Total: $ -**

I hereby certify that all the information state herein, as well as any information provided in the accompaniment herewith, is true and accurate.
Warning: HUD will prosecute false claims and statements. Conviction may result in criminal and/or civil penalties (18 U.S.C. 1001, 1010, 1012; 31 U.S.C. 3729,3802)

Mortgagor: RAD Post Oak, LLC	By:	Date:
Contractor: TBD	By:	Date:
FHA: (Processing Analyst) / Date	FHA (Chief, Cost Branch or Cost Analyst)	Date:
FHA: (Chief Underwriter)		Date:

Instructions for Completing Form HUD-2328

This form is prepared by the contractor and/or mortgagor as a requirement for the issuance of a firm commitment. The firm replacement cost of the project also serves as a basis for the disbursement of dollar amounts when insured advances are requested. A detailed breakdown of trade items is provided along with spaces to enter dollar amounts and trade descriptions.

A separate form is prepared through line 32 for each **structure type**. A summation of these structure costs are entered on line 32 of a master form. Land improvements, General Requirements and Fees are completed through line 53 on the master 2328 **only**.

Date -- Date form was prepared.
Sponsor -- Name of sponsor or sponsoring organization.
Project No. -- Eight-digit assigned project number.
Building Identification -- Number(s) or Letter(s) of each building as designated on plans.
Name of Project -- Sponsors designated name of project.
Location -- Street address, city and state.
Division -- Division numbers and trade items have been developed from the cost accounting section of the uniform system.
Accessory Structures -- This item reflects structures, such as: community, storage, maintenance, mechanical, laundry and project office buildings. Also included are garages and carports or other buildings. When the amount shown on line 33 is $20,000.00 or 2% of line 32 whichever is the lesser, a separate form HUD-2328 will be prepared through line 32 for Accessory Structures.

Unusual Site Conditions -- This trade item reflects rock excavation, high water table, excessive cut and fill, retaining walls, erosion, poor drainage and other on-site conditions considered unusual.
Cost -- Enter the cost being submitted by the Contractor or bids submitted by a qualified subcontractor for each trade item. These costs will include, as a minimum, prevailing wage rates as determined by the Secretary of Labor.
Trade Description -- Enter a brief description of the work included in each trade item.
Other Fees -- Includable are fees to be paid by the Contractor, such as sewer tap fees not included in the plumbing contract. Fees paid or to be paid by the Mortgagor are not to be included on this form.
Total For All Improvements -- This is the sum of lines 1 through 50 and is to include the total builder's profit (line 46).

Line 52–When applicable, enter that portion of the builder's profit (line 46) to be paid by means other than cash and/or any part of the builder's profit to be waived during construction.

Non-Residential and Special Exterior Land Improvements Costs – Describe and enter the cost of each improvement, i.e. on-site parking facilities including individual garages and carports, commercial facilities, swimming pools with related facilities and on-site features provided to enhance the environment and livability of the project and the neighborhood. The Design Representative and Cost Analyst shall collaborate with the mortgagor or his representative in designating the items to be included.

Off-Site Costs–Enter description and dollar amount including fees and bond premium for off-site improvements.

Demolition–Enter description and dollar amount of demolition work necessary to condition site for building improvements including the removal of existing structures, foundations, utilities, etc.

Other Fees–Enter a brief description of item involved and cost estimate for each item.

Signatures–Enter the firm name, signature of authorized officer of the contractor and/or mortgagor and date the form was completed.

Construction Progress Schedule

U.S. Department of Housing and Urban Development
Office of Public and Indian Housing

OMB Approval No. 2577-0157 (Exp. 3/31/2020)

Public reporting burden for this collection of information is estimated to average 1 hour per response, including the time for reviewing instructions, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing the collection of information. This agency may not conduct or sponsor, and a person is not required to respond to, a collection of information unless that collection displays a valid OMB control number.

Construction practices and HUD administrative requirements establish the need that HAs maintain certain records or submit certain documents in conjunction with the oversight of the award of construction contracts for the construction of new low-income housing developments or modernization of existing developments. These forms are used by HAs to provide information on the construction progress schedule and schedule of amounts for contract payments. Responses to the collection of information are required to obtain a benefit or to retain a benefit. The information requested does not lend itself to confidentiality.

1. Name of Public Housing Agency/Indian Housing Authority (PHA/IHA)

2. City	3. State	5. Project Name
		RAD Post Oak
4. Location		6. Project Number
1383 Vida Way		
7. Contract for		8. Contract Time (Days)
9. From (mm/dd/yyyy)	To (mm/dd/yyyy)	10. Contract Price $

11. Number of Buildings	12. Number of Dwelling Units	13. Number of Rooms

(Submit as many pages as necessary to cover the construction period.)	Year (yyyy)	20xx	20xx	20xx	20xx	20xx	20xx	20xx
	Month							
Actual Monthly Value, Work in Place	$							
Actual Accumulated Progress	(%)							
Anticipated Monthly Value	($)	$	$	$	$	$	$	$
Accumulated Scheduled Progress	(%)	%	%	%	%	%	%	%

Submitted by	Contractor's Name TBD		
	Title [GC Signor Title]	Signature	Date (mm/dd/yyyy)
Approved by	PHA/IHA		
	Title		Date (mm/dd/yyyy)
Approved by	Architect		Date (mm/dd/yyyy)

Construction Progress Schedule

U.S. Department of Housing and Urban Development
Office of Public and Indian Housing

OMB Approval No. 2577-0157 (Exp. 3/31/2020)

Public reporting burden for this collection of information is estimated to average 1 hour per response, including the time for reviewing instructions, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing the collection of information. This agency may not conduct or sponsor, and a person is not required to respond to, a collection of information unless that collection displays a valid OMB control number.

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1. Name of Public Housing Agency/Indian Housing Authority (PHA/IHA)

2. City	3. State	5. Project Name
0	0	RAD Post Oak
4. Location		**6. Project Number**
1383 Vida Way		0
7. Contract for		**8. Contract Time (Days)**
0		0
9. From (mm/dd/yyyy)	**To (mm/dd/yyyy)**	**10. Contract Price $**
1/0/1900	1/0/1900	$0.00

11. Number of Buildings	12. Number of Dwelling Units	13. Number of Rooms
0		

(Submit as many pages as necessary to cover the construction period.)	Year (yyyy)	20xx	20xx	20xx	20xx	20xx	20xx	20xx
	Month							
Actual Monthly Value, Work in Place	$							
Actual Accumulated Progress	(%)							
Anticipated Monthly Value	($)	$	$	$	$	$	$	$
Accumulated Scheduled Progress	(%)	%	%	%	%	%	%	%

Submitted by	Contractor's Name TBD		
	Title [GC Signor Title]	Signature	Date (mm/dd/yyyy)
Approved by	PHA/IHA		
	Title		Date (mm/dd/yyyy)
Approved by	Architect		Date (mm/dd/yyyy)

Instructions for Preparation of Construction Progress Schedule
Form HUD-5372

General. The information required for items 1 through 6 can be obtained from the contract documents. (7.) Enter the type of work awarded by the PHA/IHA. This may be "general construction," "plumbing," "heating," "electrical," etc., depending upon prime contract awards. (8.) Enter the contract time in calendar days (unless otherwise stated). (9.) Enter the starting and completion dates as established by the Notice to Proceed.

Year and Month. At the top of the Schedule, space is provided for inserting the "Year" and "Month" to identify the times during which the work is to be performed.

Year. Enter the year when the Notice to Proceed was issued. If the starting date of the contract is such that the time assigned for completion will be carried into a succeeding year, two yearly designations will be shown, each centered over the applicable spread of time for each year.

Month. The body of the Schedule is divided into Columns, each representing a period of one month. Starting in the Column with the month stated in the Notice to Proceed, enter at the top of each column the successive months corresponding to the entire spread of the total contract time. The Schedule must contain monthly columns to cover the entire active period of contract, with extra columns for possible overruns in contract time.

Computation of Anticipated Monthly Value of Work in Place

Before presenting the form for approval, enter in each monthly column the dollar value (omit cents) of the increment of work anticipated to be put in place during that interval of time. This shall be the Contractor's best estimate of the rate of progress for each month. This section contains a suggested guide for the elapsed contract time vs. progress percentages.

The horizontal total of the monthly dollars shown for "Anticipated Monthly Value" must equal the contract price shown in the heading.

Accumulated Scheduled Progress – %

Entries on this line shall show in percentage of total completion the cumulative stage of progress that is scheduled to be reached at the end of each monthly interval. It is generally sufficient to state this anticipated progress to the nearest tenth of one percent, but for very large contracts it may be advisable to extend computations to the nearest hundredth.

The entry for the first month's column should be the % obtained by the anticipated monthly dollar value of work in place at the close of the first month being divided by the contract price.

The entry for the second month's column is obtained by the sum of the anticipated monthly dollar values of work in place for Columns 1 and 2 being divided by the contract price.

Enter in the third month's column the percentage computed similarly, using the sum of dollar values of work in place for Columns 1, 2, and 3. Continue in this manner for the succeeding monthly columns until "100" is reached in the final column.

Charting Actual Progress. The horizontal space extending through the monthly columns is divided into "Actual Monthly Value of Work in Place – $" and Actual Accumulated Progress – %." In each monthly column show the actual accumulated % of progress and the actual value of work in place for that month, as the work progresses. An anticipated complete shutdown at some stage in the work because of adverse seasonal weather or otherwise, as may occur in road work, excavation (grading), etc., is readily shown by a gap.

The Contractor's name shall be placed in the lower left-hand corner of the form, together with the signature and title of the employee who prepared the Schedule and the date. The form then shall be sent to the Architect for review. If the Architect considers that changes are necessary to make the Schedule more realistic, it will withhold approval and so advise the Contractor. When the form is acceptable and approved by the Architect, and the PHA/ IHA, it will be returned to the Contractor, who shall reproduce and submit the number and style of prints required by the PHA/ IHA.

Normal building construction experience has proved that the rate of overall progress (as measured by work in place) accelerates slowly at the start, reaches its peak in the middle third of the construction period, and tapers down at the close. The data following illustrate the general average expectancy of a well-balanced operation and may be used as a guide. If the proposed progress lies within reasonable range of these check points, the Schedule may be considered satisfactory insofar as the time-performance feature is involved.

% of Contract Time	% of Accumulated Progress
0	
10	28
20	
30	20
40	37
50	57
60	75
70	89
80	96
90	99
100	100

The foregoing percentages must be tempered by consideration of seasonal weather conditions and other known conditions which may affect the progress of the work. These percentages are offered for information only.

Equal Employment Opportunity Certification
Excerpt From 41 CFR §60-1.4(b)

U.S. Department of Housing and Urban development
Office of Housing
Federal Housing Commissioner

Department of Veterans Affairs
OMB Control No. 2502-0029
(exp. 4/30/2020)

The applicant hereby agrees that it will incorporate or cause to be incorporated into any contract for construction work, or modification thereof, as defined in the regulations of the Secretary of Labor at 41 CFR Chapter 60, which is paid for in whole or in part with funds obtained from the Federal Government or borrowed on the credit of the Federal Government pursuant to a grant, contract, loan insurance, or guarantee, or undertaken pursuant to any Federal program involving such grant, contract, loan, insurance, or guarantee, the following equal opportunity clause:

During the performance of this contract, the contractor agrees as follows:

(1) The contractor will not discriminate against any employee or applicant for employment because of race, color, religion, sex, or national origin. The contractor will take affirmative action to ensure that applicants are employed, and that employees are treated during employment without regard to their race, color, religion, sex, or national origin, such action shall include, but not be limited to the following: Employment, upgrading, demotion, or transfer; recruitment or recruitment advertising; layoff or termination; rates of pay or other forms of compensation; and selection for training, including apprenticeship. The contractor agrees to post in conspicuous places, available to employees and applicants for employment, notices to be provided setting forth the provisions of this nondiscrimination clause.

(2) The contractor will, in all solicitations or advertisements for employees placed by or on behalf of the contractor, state that all qualified applicants will receive considerations for employment without regard to race, color, religion, sex, or national origin.

(3) The contractor will send to each labor union or representative of workers with which it has a collective bargaining agreement or other contract or understanding, a notice to be provided advising the said labor union or workers' representatives of the contractor's commitments under this section, and shall post copies of the notice in conspicuous places available to employees and applicants for employment.

(4) The contractor will comply with all provisions of Executive Order 11246 of September 24, 1965, and of the rules, regulations and relevant orders of the Secretary of Labor.

(5) The contractor will furnish all information and reports required by Executive Order 11246 of September 24, 1965, and by rules, regulations, and orders of the Secretary of Labor, or pursuant thereto, and will permit access to its books, records, and accounts by the administering agency and the Secretary of Labor for purposes of investigation to ascertain compliance with such rules, regulations, and orders.

(6) In the event of the contractor's noncompliance with the nondiscrimination clauses of this contract or with any of the said rules, regulations, or orders, this contract may be canceled, terminated, or suspended in whole or in part and the contractor may be declared ineligible for further Government contracts or federally assisted construction contracts in accordance with procedures authorized in Executive Order 11246 of September 24, 1965, and such other sanctions may be imposed and remedies invoked as provided in Executive Order 11246 of September 24, 1965, or by rule, regulation, or order of the Secretary of Labor, or as otherwise provided by law.

(7) The contractor will include the portion of the sentence immediately preceding paragraph (1) and the provisions of paragraphs (1) through (7) in every subcontract or purchase order unless exempted by rules, regulations, or orders of the Secretary of Labor issued pursuant to section 204 of Executive Order 11246 of September 24, 1965, so that such provisions will be binding upon each subcontractor or vendor. The contractor will take such action with respect to any subcontract or purchase order as the administering agency may direct as a means of enforcing such provisions, including sanctions for noncompliance: **Provided, however,** That in the event a contractor becomes involved in, or is threatened with, litigation with a subcontractor or vendor as a result of such direction by the administering agency the contractor may request the United States to enter into such litigation to protect the interests of the United States.

The applicant further agrees that it will be bound by the above equal opportunity clause with respect to its own employment practices when it participates in federally assisted construction work:

Provided, That if the applicant so participating is a State or local government, the above equal opportunity clause is not applicable to any agency, instrumentality or subdivision of such government which does not participate in work on or under the contract.

The applicant agrees that it will assist and cooperate actively with the administering agency and the Secretary of Labor in obtaining the compliance of contractors and subcontractors with the equal opportunity clause and the rules, regulations, and relevant orders of the Secretary of Labor, that it will furnish the administering agency and the Secretary of Labor such information as they may require for the supervision of such compliance, and that it will otherwise assist the administering agency in the discharge of the agency's primary responsibility for securing compliance.

The applicant further agrees that it will refrain from entering into any contract or contract modification subject to Executive Order 11246 of September 24, 1965, with a contractor debarred from, or who has not demonstrated eligibility for, Government contracts and Federally-assisted construction contracts pursuant to the Executive order and will carry out such sanctions and penalties for violation of the equal opportunity clause as may be imposed

Firm Name and Address	By:
TBD , , ,	Title: [GC Signor Title]

upon contractors and subcontractors by the administering agency or the Secretary of Labor pursuant to Part II, Subpart D of the Executive order. In addition, the applicant agrees that if it fails or refuses to comply with these undertakings, the administering agency may take any or all of the following actions: Cancel, terminate, or suspend in whole or in part this grant (contract, loan, insurance, guarantee); refrain from extending any further assistance to the applicant under the program with respect to which the failure or refund occurred until satisfactory assurance of future compliance has been received from such applicant; and refer the case to the Department of Justice for appropriate legal proceedings.

Excerpt from HUD Regulations

200.410Definition of term "applicant".

(a) In multifamily housing transactions where controls over the mortgagor are exercised by the Commissioner either through the ownership of corporate stock or under the provisions of a regulatory agreement, the term "applicant" as used in this subpart shall mean the mortgagor.

(b) In transactions other than those specified in paragraph(a) of this section, the term "applicant" as used in this subpart shall mean the builder, dealer or contractor performing the construction, repair or rehabilitation work for the mortgagor or other borrower.

200.420Equal Opportunity Clause to be included in contracts and subcontracts.

(a) The following equal opportunity clause shall be included in each contract and subcontract which is not exempt:

During the performance of this contract, the contractor agrees as follows:

(1) The contractor will not discriminate against any employee or applicant for employment because of race, creed, color, or national origin. The contractor will take affirmative action to ensured that applicants are employed, and that employees are treated during employment without regard to their race, creed, color, or national origin. Such action shall include, but not be limited to the following: employment, upgrading, demotion or transfer; recruitment or recruitment advertising; layoff or termination; rates of pay or other forms of compensation; and selection for training, including apprenticeship. The contractor agrees to post in conspicuous places, available to employees and applicants for employment, notices to be provided setting forth the provisions of the nondiscrimination clause.

(2)The contractor will in all solicitations or advertisements for employees placed by or on behalf of the contractor, state that all qualified applicants will receive consideration for employment without regard race, creed, color, or national origin.

(3) The contractor will send to each labor union or representative of workers with which he has a collective bargaining agreement or other contract or understanding, a notice, to be provided, advising the said labor union or workers' representative of the contractor's commitments under this section, and shall post copies of the notices in conspicuous places available to employees and applicants for employment.

(4) The contractor will comply with all provisions of Executive Order 10925 of March 6 1961, as amended, and of the regulations, and relevant orders of the President's Committee on Equal Employment Opportunity created thereby.

(5) The contractor will furnish all information and reports required by Executive Order 10925 of March 6, 1961, as amended, and by the regulations, and orders of the said Committee , or pursuant thereto, and will permit access to his books, records, and accounts by HUD and the Committee for purposes of investigation to ascertain compliance with such regulations, and orders.

(6) In the event of the contractor's non-compliance with the nondiscrimination clause of this contract or with any of the said regulations, or orders, this contract may be cancelled, terminated or suspended in whole or in part and the contractor may be declared ineligible for further Government contracts or Federally-assisted construction contracts in accordance with procedures authorized in Executive Order 10925 of March 6, 1961, as amende, and such other sanctions may be imposed and remedies invoke s provided in the said Executive Order or by regulations, or order of the President's Committee on Equal Employment Opportunity, or as otherwise provided by law.

(7) The contractor will include the provisions of Paragraphs(1) through (7) in every subcontract or purchase order unless exempted by regulations, or orders of the President's Committee on Equal Employment Opportunity issued pursuant to Section 303 of Executive Order 10925 of March 6, 1961, as amended, so that such provisions will be binding upon each subcontractor or vender. The contractor will take such action with respect to any subcontract or purchase orders as HUD may direct as a means of enforcing such provisions, including sanctions for noncompliance: Provided, however, that in the event the contractor becomes involved in, or is threatened with, litigation with a subcontractor or vender as a result of such direction by HUD, the contractor may request the United States to enter into such litigation to protect the interests of the United States.

(b) Except in subcontracts for the performance of construction work at the site of construction, the clause is not required to be inserted in subcontracts below the second tier. Subcontracts may incorporate by referenced to the equal opportunity clause.

200.425Modification in and exemptions from the regulations in this subpart.

(a) The following transactions and contracts are exempt from the regulations in this subpart:

(1) Loans, mortgages, contracts and subcontracts not exceeding $10,000.

(2) Contract and subcontracts not exceeding $100,000 for standard commercial supplies or raw material;

(3)Contracts and subcontracts under which work is to be or has been performed outside the United States and where no recruitment of workers within the United States in involved. To the extent that work pursuant to such contracts is done within the Untied States, the equal opportunity clause shall be applicable;

(4) Contracts for the sale of Government property where no appreciable amount of work is involved; and

(5) Contracts and subcontracts for an indefinite quantity which are not to extend for ore than one year if the purchaser determines that the amounts to be ordered under any such contract or subcontract are not reasonably expected to exceed $100,000 in the case of contracts or subcontracts for standard commercial supplies and raw materials, or $10,000 in the case of all other contracts and subcontracts.

FINANCIAL CERTIFICATION

RE: **RAD Post Oak**

Name: **TBD**

I hereby certify that the foregoing figures and statements contained herein submitted by me as the General Contractor for the purpose of obtaining mortgage insurance under the National Housing Act are true and give a correct showing of the General Contractor as of: YTD 2020, FYE 2019, FYE 2018, and FYE 2017.

Certified: **TBD**

By: _____
Name:
Title: [GC Signor Title]
Date: _____

WARNING: I hereby certify under penalty of perjury that all of the information I have provided on this form and in any accompanying documentation is true and accurate. I acknowledge that if I knowingly have made any false, fictitious, or fraudulent statement, representation, or certification on this form or on any accompanying documents, I may be subject to criminal, civil, and/or administrative sanctions, including fines, penalties, and/or imprisonment under applicable federal law, including but not limited to 12 U.S.C. §1833a; 18 U.S.C. §§1001, 1006, 1010, 1012, and 1014; 12 U.S.C. §1708 and 1735f-14; and 31 U.S.C. §§3729 and 3802.

Previous Participation Certification

OMB Approval No. 2502-0118
(Exp. 11/30/2022)

US Department of Housing and Urban Development
Office of Housing/Federal Housing Commissioner

US Department of Agriculture
Farmers Home Administration

Part I to be completed by Controlling Participants of Covered Projects *(See instructions)* Reason for Submission: [New Construction/Substantial Rehabilitation]	**For HUD HQ/FmHA use only**
1. Agency name and City where the application is filed U.S. Department of Housing and Urban Development [City, State]	**2.** Project Name, Project Number, City and Zip Code RAD Post Oak 1383 Vida Way, Columbus, OH, 43228 Project Number: TBD

3. Loan or Contract Amount:	**4.** Number of Units or Beds:	**5.** Section of Act:	**6.** Type of Project (check one):
[Loan App $] (est.)		[Section of the Act]	☐ Existing ☐ Rehabilitation ☐ Proposed (New)

7. List all proposed Controlling Participants and attach complete organization chart for all organizations showing ownership %

Name and address (Last, First, Middle Initial) of controlling participant(s) proposing to participate	**8. Role of Each Principal in Project**	**9. SSN or IRS Employer Number (TIN)**
TBD , , ,	General Contractor	

Certifications: The controlling participant(s) listed above hereby apply to HUD or USDA FmHA, as the case maybe, for approval to participate as controlling participant(s) in the role(s) and project listed above. The controlling participant(s) certify that the information provided on this form and in any accompanying documentation is true and accurate. I/we acknowledge that making, presenting, or submitting a false, fictitious, or fraudulent statement, representation, or certification may result in criminal, civil, and/or administrative sanctions, including fines, penalties, and imprisonment. The controlling participant(s) further certify to the truth and accuracy of the following:

1. Schedule A contains a listing, for the last ten years, of every project assisted or insured by HUD, USDA FmHA and/or State and local government housing finance agencies in which the controlling participant(s) have participated or are now participating.
2. For the period beginning 10 years prior to the date of this certification, and except as shown on the certification:
a. No mortgage on a project listed has ever been in default, assigned to the Government or foreclosed, nor has it received mortgage relief from the mortgagee;
b. The controlling participants have no defaults or noncompliance under any Conventional Contract or Turnkey Contract of Sale in connection with a public housing project;
c. There are no known unresolved findings as a result of HUD audits, management reviews or other Governmental investigations concerning the controlling participants or their projects;
d. There has not been a suspension or termination of payments under any HUD assistance contract due to the controlling participant's fault or negligence;
e. The controlling participants have not been convicted of a felony and are not presently the subject of a complaint or indictment charging a felony. (A felony is defined as any offense punishable by imprisonment for a term exceeding one year, but does not include any offense classified as a misdemeanor under the laws of a State and punishable by imprisonment of two years or less);
f. The controlling participants have not been suspended, debarred or otherwise restricted by any Department or Agency of the Federal Government or of a State Government from doing business with such Department or Agency;
g. The controlling participants have not defaulted on an obligation covered by a surety or performance bond and have not been the subject of a claim under an employee fidelity bond.
3. All the names of the controlling participants who propose to participate in this project are listed above.
4. None of the controlling participants is a HUD/FmHA employee or a member of a HUD/FmHA employee's immediate household as defined in Standards of Ethical Conduct for Employees of the Executive Branch in 5 C.F.R. Part 2635 (57 FR 35006) and HUD's Standard of Conduct in 24 C.F.R. Part 0 and USDA's Standard of Conduct in 7 C.F.R. Part 0 Subpart B.
5. None of the controlling participants is a participant in an assisted or insured project as of this date on which construction has stopped for a period in excess of 20 days or which has been substantially completed for more than 90 days and documents for closing, including final cost certification, have not been filed with HUD or FmHA
6. None of the Controlling participants have been found by HUD or FmHA to be in noncompliance with any applicable fair housing and civil rights requirements in 24 CFR 5.105(a). (If any controlling participants have been found to be in noncompliance with any requirements, attach a signed statement explaining the relevant facts, circumstances, and resolution, if any).
7. None of the controlling participants is a Member of Congress or a Resident Commissioner nor otherwise prohibited or limited by law from contracting with the Government of the United States of America.
8. Statements above (if any) to which the controlling participant(s) cannot certify have been deleted by striking through the words with a pen, and the controlling participant(s) have initialed each deletion (if any) and have attached a true and accurate signed statement (if applicable) to explain the facts and circumstances.

Name of Controlling Participant	Signature of Controlling Participant	Certification Date (mm/dd/yyyy)	Area Code and Telephone No.
TBD			
This form prepared by (print name)		Area code and Tel. No.	

Schedule A: List of Previous Projects and Section 8 Contracts. Below is a complete list of the controlling participants' previous participation projects and participation history in covered projects as per 24 CFR, part 200 §200.214 and multifamily Housing programs of FmHA, State and local Housing Finance Agencies, if applicable. Note: Read and follow the instruction sheet carefully. Make full disclosure. Add extra sheets if you need more space. Double check for accuracy. If no previous projects, write by your name, **"No Previous Participation, First Experience**".

1. Controlling Participants' Name (Last, First)	2. List of previous projects (Project name, project ID and, Govt. Agency involved)	3. List Participants' Role(s) (indicate dates participated, and if fee or identity of interest participant)	4. Status of Loan (current, defaulted, assigned, foreclosed)	5. Was the Project ever in default during your participation			6. Last MOR rating and Physical Insp. Score and date
				Yes	No	If Yes, explain	

Part II - For HUD Internal Processing Only

Received and checked by me for accuracy and completeness; recommend approval or refer to Headquarters after checking appropriate box.

Date (mm/dd/yyyy)	Tel No. and area code	☐ A. No adverse information; form HUD- approval recommended.	☐ C. Disclosure or Certification problem
Staff	Processing and Control	☐ B. Name match in system	☐ D. Other (attach memorandum)

Signature of authorized reviewer	Signature of authorized reviewer	Approved ☐ Yes ☐ No	Date (mm/dd/yyyy)

Instructions for Completing the Previous Participation Certificate, form HUD-2530

Carefully read these instructions and the applicable regulations. A copy of the regulations published at 24 C.F.R. part 200, subpart H, § 200.210-200.222 can be obtained on-line at www.gpo.gov and from the Account Executive at any HUD Office. Type or print neatly in ink when filling out this form. Incomplete form will be returned to the applicant.

Attach extra sheets as you need them. Be sure to indicate "Continued on Attachments" wherever appropriate. Sign each additional page that you attach if it refers to you or your record. **Carefully read the certification before you sign it.** Any questions regarding the form or how to complete it can be answered by your HUD Account Executive.

Purpose: This form provides HUD/USDA FmHA with a certified report of all previous participation in relevant HUD/USDA programs by those parties submitting the application. The information requested in this form is used by HUD/USDA to determine if you meet the standards established to ensure that all controlling participants in HUD/USDA projects will honor their legal, financial and contractual obligations and are of acceptable risks from the underwriting standpoint of an insurer, lender or governmental agency. HUD requires that you certify and submit your record of previous participation, in relevant projects, by completing and signing this form, before your participation can be approved.

HUD approval of your certification is a necessary precondition for your participation in the project and in the capacity that you propose. If you do not file this certification, do not furnish the information requested accurately, or do not meet established standards, HUD will not approve your certification.

Note that approval of your certification does not obligate HUD to approve your project application, and it does not satisfy all other HUD program requirements relative to your qualifications.

Who Must Sign and File Form HUD-2530: Form HUD-2530 must be completed and signed by all Controlling Participants of Covered Projects, as such terms are defined in 24 CFR part 200 §200.212, and as further clarified by the Processing Guide (HUD notice H 2016-15) referenced in 24 CFR §200.210(b) and available on the HUD website at: http://portal.hud.gov/hudportal/HUD?src=/program_offices/housing/mfh/prevparticipation.

Where and When Form HUD-2530 Must Be Filed: The original of this form must be submitted to the HUD Office where your project application will be processed at the same time you file your initial project application. This form must be filed with applications for projects listed in 24 CFR §200.214 and for the Triggering Events listed at 24 CFR §200.218.

Review of Adverse Determination: If approval of your participation in a HUD project is denied, withheld, or conditionally granted on the basis of your record of previous participation, you will be notified by the HUD Office. You may request reconsideration in accordance with 24 CFR §200.222 and further clarified by the Processing Guide. Request must be made in writing within 30 days from your receipt of the notice of determination.

The Department of Housing and Urban Development (HUD) is authorized to collect this information by law 42 U.S.C. 3535(d) and by regulation at 24 CFR 200.210. This information is needed so that principals applying to participate in multifamily programs can become HUD-approved controlling participants. The information you provide will enable HUD to evaluate your record with respect to established standards of performance, responsibility and eligibility. Without prior approval, a controlling participant may not participate in a proposed or existing multifamily or healthcare project. HUD uses this information to evaluate whether or not controlling participants pose an unsatisfactory underwriting risk. The information is used to evaluate the potential controlling participants and approve only individuals and organizations that will honor their legal, financial and contractual obligations.

Privacy Act Statement: The Housing and Community Development Act of 1987, 42 U.S.C. 3543 requires persons applying for a Federally-insured or guaranteed loan to furnish his/her Social Security Number (SSN). HUD must have your SSN for identification of your records. HUD may use your SSN for automated processing of your records and to make requests for information about you and your previous records with other public agencies and private sector sources. HUD may disclose certain information to Federal, State and local agencies when relevant to civil, criminal, or regulatory investigations and prosecutions. It will not be otherwise disclosed or released outside of HUD, except as required and permitted by law. You must provide all of the information requested in this application, including your SSN.

Public reporting burden for this collection of information is estimated to average three hour per response, including the time for reviewing instructions, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing the collection of information. This agency may not collect this information, and you are not required to complete this form, unless it displays a currently valid OMB control number.

A response is mandatory. Failure to provide any of the information will result in your disapproval of participation in this HUD program.

STATEMENT REGARDING OTHER BUSINESS CONCERNS

RE: **RAD Post Oak**

Name: TBD

Relationship to the Subject Project: **General Contractor**

Listed below is a list of other related business concerns in which the party named above serves as a general partner, limited partner with a 25% or more interest, a stockholder with a 10% or more interest or a corporate officer.

Do not include any HUD or Farmers' Home Administration insured projects.

BUSINESS NAME	TYPE OF BUSINESS	PERCENT OF OWNERSHIP INTEREST OR POSITION	DETAILS RELATIVE TO ANY PENDING JUDGMENTS LEGAL ACTIONS OR SUITS OR BANKRUPTCY CLAIMS

By: _____
Name:
Title: [GC Signor Title]
Date: _____

WARNING: I hereby certify under penalty of perjury that all of the information I have provided on this form and in any accompanying documentation is true and accurate. I acknowledge that if I knowingly have made any false, fictitious, or fraudulent statement, representation, or certification on this form or on any accompanying documents, I may be subject to criminal, civil, and/or administrative sanctions, including fines, penalties, and/or imprisonment under applicable federal law, including but not limited to 12 U.S.C. §1833a; 18 U.S.C. §§1001, 1006, 1010, 1012, and 1014; 12 U.S.C. §1708 and 1735f-14; and 31 U.S.C. §§3729 and 3802.

Supplement to Application for a Multifamily Housing Project

U.S. Department of Housing and Urban Development
Office of Housing
Federal Housing Commissioner

OMB No. 2502-0029
(exp. 04/30/2020)

To Be Completed by Each Sponsor and by the General Contractor

Public reporting burden for this collection of information is estimated to average 2 hours per response, including the time for reviewing instructions, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing the collection of information. This collection of information is required under Section 207(b) of the National Housing Act (Public Law 479, 48 Stat. 1246, 12 U.S.C. 1701, et. seq.), authorizing the Secretary of HUD to insure mortgages. The information is used by HUD to verify the credit status of the applicants for mortgage insurance, including the principal sponsors and the general contractor. The information is also authorized by 24 CFR 207.17 and is being collected by HUD to facilitate the evaluation of multiple participation.

Privacy Act Statement. The U.S. Housing Act of 1937, as amended, authorizes HUD to collect this information. The Housing and Community Development Act of 1987, 42 U.S.C. 3543 authorizes HUD to collect Social Security Numbers (SSN) or Employee Identification Numbers (EIN). Providing the SSN is mandatory for the sponsor, mortgagor, borrower and owner, and failure to provide it could result in disapproval of participation in this HUD program and/or delay action on the proposal. Submission of the SSN is voluntary for all other participants. The SSN is used as a unique identifier. HUD may disclose this information to Federal, State, and local agencies when relevant to civil, criminal, or regulatory investigations and prosecutions. It will not be otherwise disclosed or released outside HUD, except as required and permitted by law. You must provide all of the information requested in this application, including your SSN or EIN. Failure to provide the information may result in HUD's denial of proposed management or fees or cancellation of management contracts for noncompliance with HUD procedures.

Project Name	Project Number	Applicant's Name
RAD Post Oak	**TBD**	**TBD**

Applicant's Address	Telephone Number
, , ,	

Describe Your Affiliation with the Project

General Contractor

Credit References: Include all Bank, Finance, Trade and Supply Creditors. **You may omit creditors with balances less than $200.00**

Firm Name	Address		
Telephone Number	Account Number	Present Balance	Terms
Firm Name	Address		
Telephone Number	Account Number	Present Balance	Terms
Firm Name	Address		
Telephone Number	Account Number	Present Balance	Terms
Firm Name	Address		
Telephone Number	Account Number	Present Balance	Terms
Firm Name	Address		
Telephone Number	Account Number	Present Balance	Terms
Firm Name	Address		
Telephone Number	Account Number	Present Balance	Terms

Other References: ☐ Check here if other references are provided on a separate sheet.

1. Are you or have you been delinquent on any Federal debt? If Yes, attach a letter from the affected agency that the debt is satisfied or under a workout agreement. ☐ Yes ☐ No

2. Are you or have you been a defendant in any suit or legal action? ☐ Yes ☐ No

3. Have you ever claimed bankruptcy or made compromised settlements with creditors? ☐ Yes ☐ No

4. Are there judgments recorded against you? ☐ Yes ☐ No

If the answer to any of questions 1 through 4 is yes, mark this block and give the details on a separate sheet. ☐

Sponsor: I certify that the foregoing, submitted by me, for the purpose of obtaining mortgage insurance under the National Housing Act, or a Capital Advance under the Housing Act of 1959, as amended, or Section 811 of the National Affordable Housing Act of 1990, is true and correct to the best of my knowledge and belief.

Sponsor's Signature and Date (mm/dd/yyyy)

X Date:

Social Security Number (or EIN)

Contractor: I certify that the foregoing, submitted by me, is true and correct to the best of my knowledge and belief.

Contractor's Signature and Date (mm/dd/yyyy)

TBD

X Date:

[GC Signor Title]

Employee Identification Number

Warning: HUD will prosecute false claims and statements. Conviction may result in criminal and/or civil penalties. (18 U.S.C. 1001, 1010, 1012; 31 U.S.C. 3729, 3802)

CONTRACTOR'S WORK IN PROGRESS
RAD Post Oak

Projects in Progress	Original Contract Price	Construction Start Date	Construction Completion Date	% of Project Completed As Of [Add Date]	Contract Balance Remaining As Of [Add Date]
TOTAL	$0				$0

TBD

Prepared By: _____

[GC Signor Title]

Date: _____

WARNING: I hereby certify under penalty of perjury that all of the information I have provided on this form and in any accompanying documentation is true and accurate. I acknowledge that if I knowingly have made any false, fictitious, or fraudulent statement, representation, or certification on this form or on any accompanying documents, I may be subject to criminal, civil, and/or administrative sanctions, including fines, penalties, and/or imprisonment under applicable federal law, including but not limited to 12 U.S.C. §1833a; 18 U.S.C. §§1001, 1006, 1010, 1012, and 1014; 12 U.S.C. §1708 and 1735f-14; and 31 U.S.C. §§3729 and 3802.

This is what it looks like:

AIA® Document A305™ – 1986

Contractor's Qualification Statement

The Undersigned certifies under oath that the information provided herein is true and sufficiently complete so as not to be misleading.

SUBMITTED TO:

ADDRESS:

SUBMITTED BY:

NAME:

ADDRESS:

PRINCIPAL OFFICE:

[ ] Corporation
[ ] Partnership
[ ] Individual
[ ] Joint Venture
[ ] Other

NAME OF PROJECT *(if applicable)*:

TYPE OF WORK (file separate form for each Classification of Work):

[ ] General Construction
[ ] HVAC
[ ] Electrical
[ ] Plumbing
[ ] Other (please specify)

ADDITIONS AND DELETIONS:
The author of this document has added information needed for its completion. The author may also have revised the text of the original AIA standard form. An *Additions and Deletions Report* that notes added information as well as revisions to the standard form text is available from the author and should be reviewed. A vertical line in the left margin of this document indicates where the author has added necessary information and where the author has added to or deleted from the original AIA text.

This document has important legal consequences. Consultation with an attorney is encouraged with respect to its completion or modification.

This form is approved and recommended by the American Institute of Architects (AIA) and The Associated General Contractors of America (AGC) for use in evaluating the qualifications of contractors. No endorsement of the submitting party or verification of the information is made by AIA or AGC.

§ 1. ORGANIZATION

§ 1.1 How many years has your organization been in business as a Contractor?

§ 1.2 How many years has your organization been in business under its present business name?

§ 1.2.1 Under what other or former names has your organization operated?

§ 1.3 If your organization is a corporation, answer the following:

§ 1.3.1 Date of incorporation:

§ 1.3.2 State of incorporation:

§ 1.3.3 President's name:

§ 1.3.4 Vice-president's name(s)

§ 1.3.5 Secretary's name:

§ 1.3.6 Treasurer's name:

§ 1.4 If your organization is a partnership, answer the following:

§ 1.4.1 Date of organization:

§ 1.4.2 Type of partnership (if applicable):

§ 1.4.3 Name(s) of general partner(s)

§ 1.5 If your organization is individually owned, answer the following:

§ 1.5.1 Date of organization:

§ 1.5.2 Name of owner:

§ 1.6 If the form of your organization is other than those listed above, describe it and name the principals:

§ 2. LICENSING

§ 2.1 List jurisdictions and trade categories in which your organization is legally qualified to do business, and indicate registration or license numbers, if applicable.

§ 2.2 List jurisdictions in which your organization's partnership or trade name is filed.

§ 3. EXPERIENCE

§ 3.1 List the categories of work that your organization normally performs with its own forces.

§ 3.2 Claims and Suits. (If the answer to any of the questions below is yes, please attach details.)

§ 3.2.1 Has your organization ever failed to complete any work awarded to it?

§ 3.2.2 Are there any judgments, claims, arbitration proceedings or suits pending or outstanding against your organization or its officers?

§ 3.2.3 Has your organization filed any law suits or requested arbitration with regard to construction contracts within the last five years?

§ 3.3 Within the last five years, has any officer or principal of your organization ever been an officer or principal of another organization when it failed to complete a construction contract? (If the answer is yes, please attach details.)

§ 3.4 On a separate sheet, list major construction projects your organization has in progress, giving the name of project, owner, architect, contract amount, percent complete and scheduled completion date.

§ 3.4.1 State total worth of work in progress and under contract:

§ 3.5 On a separate sheet, list the major projects your organization has completed in the past five years, giving the name of project, owner, architect, contract amount, date of completion and percentage of the cost of the work performed with your own forces.

§ 3.5.1 State average annual amount of construction work performed during the past five years:

§ 3.6 On a separate sheet, list the construction experience and present commitments of the key individuals of your organization.

§ 4. REFERENCES

§ 4.1 Trade References:

§ 4.2 Bank References:

§ 4.3 Surety:

§ 4.3.1 Name of bonding company:

§ 4.3.2 Name and address of agent:

§ 5. FINANCING

§ 5.1 Financial Statement.

§ 5.1.1 Attach a financial statement, preferably audited, including your organization's latest balance sheet and income statement showing the following items:

Current Assets (e.g., cash, joint venture accounts, accounts receivable, notes receivable, accrued income, deposits, materials inventory and prepaid expenses);

Net Fixed Assets;

Other Assets;

Current Liabilities (e.g., accounts payable, notes payable, accrued expenses, provision for income taxes, advances, accrued salaries and accrued payroll taxes);

Other Liabilities (e.g., capital, capital stock, authorized and outstanding shares par values, earned surplus and retained earnings).

§ 5.1.2 Name and address of firm preparing attached financial statement, and date thereof:

§ 5.1.3 Is the attached financial statement for the identical organization named on page one?

§ 5.1.4 If not, explain the relationship and financial responsibility of the organization whose financial statement is provided (e.g., parent-subsidiary).

§ 5.2 Will the organization whose financial statement is attached act as guarantor of the contract for construction?

§ 6. SIGNATURE

§ 6.1 Dated at this day of

Name of Organization:

By:

Title:

§ 6.2

being duly sworn deposes and says that the information provided herein is true and sufficiently complete so as not to be misleading.

Subscribed and sworn before me this day of 20

Notary Public:

My Commission Expires:

Additions and Deletions Report for
AIA® Document A305™ – 1986

This Additions and Deletions Report, as defined on page 1 of the associated document, reproduces below all text the author has added to the standard form AIA document in order to complete it, as well as any text the author may have added to or deleted from the original AIA text. Added text is shown underlined. Deleted text is indicated with a horizontal line through the original AIA text.

Note: This Additions and Deletions Report is provided for information purposes only and is not incorporated into or constitute any part of the associated AIA document. This Additions and Deletions Report and its associated document were generated simultaneously by AIA software at 13:28:18 on 03/22/2006.

PAGE 6

~~M~~—being duly sworn deposes and says that the information provided herein is true and sufficiently complete so as not to be misleading.

...

Subscribed and sworn before me this day of ~~20~~20

Certification of Document's Authenticity

AIA® Document D401™ – 2003

I, Charles V. Bucci, hereby certify, to the best of my knowledge, information and belief, that I created the attached final document simultaneously with its associated Additions and Deletions Report and this certification at 13:28:18 on 03/22/2006 under Order No. 1000201877_1 from AIA Contract Documents software and that in preparing the attached final document I made no changes to the original text of AIA® Document A305™ – 1986 - Contractor's Qualification Statement, as published by the AIA in its software, other than those additions and deletions shown in the associated Additions and Deletions Report.

_____

(Signed)

_____

(Title)

_____

(Dated)

SECTION 01 45 33

SPECIAL INSPECTIONS AND STRUCTURAL TESTS

PART 1 GENERAL'

1.01 GENERAL REQUIREMENTS

A. Special Inspections and Structural Testing shall be in accordance with Chapter 17 of the **2017** Ohio Building Code.

B. The program of Special Inspection and Structural Testing is a Quality Assurance program intended to ensure that the work is performed in accordance with the Contract Documents.

C. This specification section is intended to inform the Contractor of the Owner's quality assurance program and the extent of the Contractor's responsibilities. This specification section is also intended to notify the Special Inspector, Testing Laboratory and other Agents of the Special Inspector of their requirements and responsibilities.

D. The Owner has obtained the services to perform the special inspections and structural testing required by Chapter 17 of the 2011 Ohio Building Code.

1.02 CONTRACTOR RESPONSIBILITIES

A. The Contractor shall cooperate with the Special Inspector and his agents so that the special inspections and testing may be performed without hindrance.

B. The Contractor shall be responsible for coordinating and scheduling inspections and tests. The Contractor shall notify the Special Inspector or Testing Laboratory at least 24 hours in advance of a required inspection or test. Uninspected work that required inspection may be rejected solely on that basis.

C. The Contractor shall provide incidental labor and facilities to provide access to the work to be inspected or tested,, to obtain and handle samples at the site or at source of products to be tested, to facilitate tests and inspections, storage and curing of test samples.

D. The Contractor shall keep at the project site the latest set of construction drawings, field sketches, approved shop drawings, and specifications for use by the inspectors and testing technicians.

E. The Special Inspection program shall in no way relieve the Contractor of his obligation to perform work in accordance with the requirements of the Contract Documents or from implementing an effective Quality Control program.

All work that is to be subjected to Special Inspections shall first be reviewed by the

Contractor's quality control personnel.

F. The Contractor shall be solely responsible for construction site safety.

1.03 LIMITS OF AUTHORITY

A. The Special Inspector or Testing Laboratory may not release, revoke, alter, or enlarge on the requirements of the Contract Documents.

B. The Special Inspector or Testing Laboratory will not have control nor responsibility over the Contractor's means and methods of construction.

C. The Special Inspector or Testing Laboratory shall not be responsible for construction site safety.

D. The Special Inspector or Testing Laboratory has no authority to stop the work.

END OF SECTION

SECTION 03 01 30

CONCRETE CLEANING AND SEALING

PART 1 GENERAL

1.01 WORK INCLUDED

A. Clean concrete surfaces and seal with clear compound specified herein. Coordinate sealer application with concrete curing compound (See Section 03 30 00).

1.02 RELATED SECTIONS

A. Sustainable Design Requirements: Section 01 81 13.

B. VOC Limits: Section 01 81 16

C. Cast in Place Concrete: Section 03 30 00.

1.03 REFERENCES

A. ACI 515.1R - Guide to the Use of Waterproofing, Dampproofing, Protective, and Decorative Barrier Systems for Concrete.

1.04 SUBMITTALS

A. Product Data: For each type of product. Include construction details, material descriptions, chemical composition, physical properties, test data, and mixing, preparation, and application instructions.

B. Sustainable Design Documentation Submittals: Comply with Section 01 81 13.

1. VOC Limits: Include documentation verifying product Low Emitting Material Building Product Disclosures and Optimization.

1.05 QUALITY ASSURANCE

A. Manufacturer: Certify in writing that proposed materials meet or exceed specifications and are appropriate for intended use.

B. Test Sample: Identify an area approximately 36” x 36” where a test cleaning can be performed and sealer application can be applied. Obtain Architect’s approval of test area prior to start of test. Clean area and apply sealer using materials and methods proposed for the project. Repeat sample applications until approval by Architect. After sample's acceptance by the Architect, sample will be regarded as the minimum standard of workmanship/finish acceptable for the project.

1.06 PROJECT CONDITIONS

A. Do not apply materials when temperature is expected to be below 40° F within 48 hours or when rain is imminent.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials to site in manufacturer's original, unopened containers and packaging, with labels clearly identifying product name and manufacturer.

B. Store materials in a clean, dry area in accordance with manufacturer's instructions.

C. Keep product from freezing.

D. Avoid direct contact with this product as it may cause mild-to-moderate irritation of the eyes and/or skin.

E. Protect materials during handling and application to prevent damage or contamination.

F. Use product full strength from the container.

G. Dispose of material according to all local, state and federal regulations.

PART 2 PRODUCTS

2.01 MATERIALS, GENERAL

A. Source Limitations: Obtain each color, grade, finish, type, and variety of product from single source with resources to provide products of consistent quality in appearance and physical properties.

B. General: Provide materials that comply with Project Sustainable Design Requirements and Low Emitting Material goals.

2.02 CONCRETE CLEANING MATERIAL

A. Description: Pre-mixed, pre-packaged degreaser/stripper.

B. Manufacturer and Product: Citrex by L & M CHEMICAL or Ultrite Degreaser by W. R. MEADOWS. Products by CHEM MASTERS, DAYTON SUPERIOR; MASTER BUILDERS SOLUTIONS; SURE BUILDING CHEMICALS or CONPROCO are acceptable providing they meet the requirements specified.

C. Properties

1. Appearance: Clear.
2. pH: 10.9.
3. Biodegradable: 100% after dilution.

2.03 CONCRETE SEALER

A. Description: Clear, one component, transparent, acrylic copolymer sealer. 2-coat application.

B. Primer: Type as recommended by sealer manufacturer.

C. Properties

1. VOC Content: Less than 170 g/L.
2. Solids: 30%.
3. ASTM C 1315, Type 1, Class A

D. Manufacturer and Product: Dress and Seal WB 30 by L & M CHEMICAL or ~~equal~~ products by CHEMMASTERS, DAYTON SUPERIOR; MASTER BUILDERS SOLUTIONS; SURE BUILDING CHEMICALS; W. R. MEADOWS or CONPROCO.

PART 3 EXECUTION

3.01 EXAMINATION

A. Examine surfaces to receive concrete degreaser. Notify architect if surfaces are not acceptable. Do not begin application until unacceptable conditions have been corrected.

3.02 SURFACE PREPARATION

A. Protect adjacent surfaces not designated to receive concrete degreaser.

B. Follow ACI Guide 515.1R (Section 3.4.2) for severe oil and grease stains.

C. Clean surfaces of residual flooring adhesive and other foreign deposits using warm water, scraping, adhesive removing chemicals or similar methods.

3.03 APPLICATION

A. Cleaner

1. Conform to manufacturer's requirements and recommendations. Apply in number of applications as required.
2. Finish cleaned surface to match test sample area.

B. Sealer

1. Verify that slab surfaces have been cleaned in accordance with sealer manufacturer requirements.
2. Conform to manufacturer's requirements and recommendations. Provide two coats. Apply first coat at approximately 300 square feet per gallon;

second coat at approximately 400 square feet per gallon.

3. Do not thin material.

3.04 CLEANUP

A. Dispose of material according to local, state, and federal regulations.

B. Clean all tools and equipment with water.

END OF SECTION

SECTION 04 00 00

MASONRY

PART 1 GENERAL

1.01 WORK INCLUDED

A. Provide the following:

1. Face brick.
2. Concrete masonry units.
   a. Standard
3. Provide masonry fill concrete and reinforcing steel where indicated on drawings. See Section 03 30 00.
4. Wall reinforcing and accessories.
5. Through-wall flashing.
6. Mortar and grout.

1.02 RELATED SECTIONS

A. Sustainable Design Requirements: Section 01 81 13.

B. VOC Limits: Section 01 81 16.

1.03 DEFINITIONS

A. Reinforced Masonry: Masonry containing reinforcing steel in grouted cells.

1.04 SUBMITTALS

A. Product Data: For each different masonry unit, accessory and other manufactured products specified.

B. Shop Drawings: Show fabrication and installation details for the following:

1. Reinforcing Steel: Detail bending and placement of unit masonry reinforcing bars. Comply with ACI 315, “Details and Detailing of Concrete Reinforcement”. Show elevations of reinforced walls.
2. Fabricated Flashing: Detail corner units, end-dam units, and other special applications.

C. Samples: Provide samples of items specified herein to be used in the work.

D. Submit certification that fire resistant concrete units conform to the requirements specified herein for Fire Resistant Concrete Block.

E. Brick Cleaner

1. Applicator Qualifications: Submit qualifications of applicator.
   a. Certification stating applicator is experienced in the application of the specified products.

   b. List of recently completed masonry cleaning projects, including project name and location, names of owner and Architect, description of cleaning products used and substrates, applicable local environmental regulations, and application procedures.
2. Environmental Regulations: Submit description for testing, handling, treatment, containment, collection, transport, disposal, and discharge of hazardous wastes and cleaning effluents. Describe any hazardous materials to be cleaned from substrates. Submit applicable local environmental regulations.
3. Protection: Submit description for protecting surrounding areas, landscaping, building occupants, pedestrians, vehicles, and nonmasonry surfaces during the work from contact with masonry cleaners, stain removers, residues, rinse water, fumes, wastes, and cleaning effluents.
4. Surface Preparation: Submit description for surface preparation of substrates to be completed before application of masonry cleaners and stain removers.
5. Application: Submit description for application procedures of masonry cleaners.

F. Material Test Reports: From a qualified testing agency indicating and interpreting test results of the following for compliance with requirements indicated.

   1. Each type of masonry unit required.
      a. Include size-variation data for brick, verifying that actual range of sizes falls within specified tolerances.
      b. Include test results, measurements, and calculations establishing net-area compressive strength of masonry units.
   2. Mortar complying with property requirements of ASTM C270.
   3. Grout mixes complying with compressive strength requirements of ASTM C476. Include description of type and proportions of grout ingredients.

G. Material Certificates: Signed by manufacturers certifying that each of the following items complies with requirements:

   1. Each type of masonry unit required.
      a. Include test data, measurements, and calculations establishing net-area compressive strength of masonry units.
   2. Each combination of masonry unit type and mortar type. Include statement of net-area compressive strength of masonry units, mortar type, and net-area compressive strength of masonry determined according to Tables 1 and 2 in ACI 530.1/ASCE 6/TMS 602.
   3. Each material and grade indicated for reinforcing bars.
   4. Each type and size of joint reinforcement.
   5. Each type and size of anchor, tie, and metal accessory.

H. Cold-Weather Procedures: Detailed description of methods, materials and

equipment to be used to comply with cold-weather requirements.

I. Sustainable Design Documentation Submittals: Comply with Section 01 81 13.

1. VOC Limits: Include documentation verifying product Low Emitting Material Building Product Disclosures and Optimization.

1.05 QUALITY ASSURANCE

A. Supervisor: A supervisory journeyman mason shall be appointed for the project and shall be present at all times masonry work is being performed and:

1. have a minimum of 5 years experience on masonry projects of this type and size.
2. be thoroughly familiar with the design requirements, types of materials being installed, referenced standards and other requirements.

B. Use only skilled journeyman masons for cutting and placing of masonry; no allowance shall be made for lack of skill on the part of the workmen.

C. Consult other trades and make provisions that shall permit the installation of their work in a manner to avoid cutting and patching. Build-in work under other sections, as necessary, and as the work progresses.

D. Unit Masonry Standard: Comply with ACI 530.1/ASCE 6/TMS 602, 2013 Edition "Specifications for Masonry Structures". Maintain one copy of the standard in project field office at all times during construction. Contractor's supervisory personnel shall be thoroughly familiar with the material as it applies to this Project.

E. Concrete Unit Masonry Construction: Comply with the National Concrete Masonry Association (NCMA) "TEK Bulletins", and other requirements specified.

1. NCMA TEK Bulletin 3-02A "Grouting for Concrete Masonry Walls".
2. NCMA TEK Bulletin 8-02A "Removal of Stains from Concrete Masonry Walls".
4. NCMA TEK Bulletin 10-01A "Crack Control in Concrete Masonry Walls".
5. NCMA TEK Bulletin 10-02C "Control Joints for Concrete Masonry Walls".
6. NCMA TEK Bulletin 14-2 "Reinforced Concrete Masonry".
7. NCMA TEK Bulletin 19-04A "Flashing Concrete Masonry".
8. NCMA TEK Bulletin 19-05A "Use of Flashing in Concrete Masonry Walls".

F. Brick Industry Association (BIA)

1. BIA Technical Notes No. 8 and 8B: Mortar for Brickwork.
2. BIA Technical Notes No. 20: Cleaning Brick Masonry.
3. BIA Technical Notes No. 28B: Brick Veneer.

G. Sample Panels

1. Construct where approved by Architect.

2. Panel shall be at least 6 feet long by 6 feet high and shall show full color range, joint detail, reinforcement, air barrier, insulations, through-wall flashing and drips, cavity drainage material, weeps and all other details of construction that will be used in the completed work. Include at least one 90° corner.
   a. Include brick masonry.
   b. Clean sample panel using the same methods and materials that will be utilized for cleaning the building masonry.
3. Construct additional panels as required by Architect if original panel construction is not acceptable.
4. Do not start masonry construction until the sample panel is approved by the Architect.
5. Retain acceptable sample as reference standard for the project.
6. Demolish and remove panel from site after acceptance of work.

1.06 DELIVERY, STORAGE AND HANDLING

A. Store cement and lime materials and masonry units off the ground, under cover and protected from weather damage. If units become wet, do not install until they are dry. Do not use cementitious materials that have become damp.

C. Stockpile and store aggregates to prevent contamination from foreign materials, in locations where grading and other required characteristics can be maintained.

D. Use care in handling units to avoid chipping and breakage.

E. Locate storage areas where they will not be disturbed or damaged by construction operations.

F. Protect finished floor areas from damage.

1.07 COLD WEATHER CONSTRUCTION

A. Comply with recommended practices for cold weather construction of the International Masonry Industry All-Weather Council and requirements contained in ACI 530.1/ASCE 6/TMS 602.

B. Do not build on frozen or snow covered work. Remove and replace masonry work damaged by frost or freezing.

C. Requirements During Construction: Provide the following minimum requirements for the air temperatures listed:

1. Above 40° F: Normal masonry procedures.
2. 40° F to 32° F: Heat mixing water to produce mortar temperatures between 40° F and 120° F. Produce consecutive batches of mortar with the same temperatures falling within this range. Do not heat mortar to greater than 120° F.

3. Below 32° F to 25° F: Heat sufficient mortar ingredients to produce mortar

temperatures between 40° F and 120° F. Produce consecutive batches of mortar with the same temperatures falling within this range. Maintain mortar temperatures after mixing above 40° F. Do not heat mortar to greater than 120° F.

4. Below 25° F to 20° F: Heat sufficient mortar ingredients to produce mortar temperatures between 40° F and 120° F. Produce consecutive batches of mortar with the same temperatures falling within this range. Maintain mortar temperatures after mixing above 40° F. Do not heat mortar to greater than 120° F. Maintain masonry above freezing using auxiliary heat. Provide enclosure when wind is in excess of 15 mph.
5. Below 20° F: Heat sufficient mortar ingredients to produce mortar temperatures between 40° F and 120° F. Produce consecutive batches of mortar with the same temperatures falling within this range. Maintain mortar temperatures after mixing above 40° F. Do not heat mortar to greater than 120° F. Maintain masonry above freezing using enclosure and auxiliary heat.

D. Protection Requirements for Completed Masonry (and masonry not being worked on): Provide the following minimum requirements for the mean daily air temperatures listed:

1. Above 40° F: Normal masonry procedures.
2. 40° F to 32° F: Protect from rain or snow for 24 hours with weather-resistive membrane.
3. Below 32° F to 20° F: Completely cover with weather-resistive membrane and maintain above freezing for 24 hours.
4. Below 20° F: Provide weather-resistant enclosure and auxiliary heat to maintain above freezing for 24 hours.

E. Requirements During Grouting Operations (Vertically Reinforced Walls): Provide the following minimum requirements for the air temperatures listed:

1. Above 32° F: Normal masonry procedures. Cover at end of work day with weather-resistive membrane.
2. 32° F to 20° F: Heat grout materials to 90° F so grout has in-place temperature of 70° F at end of work day. Cover at end of work day with weather-resistive membrane and 1/2" thick insulating blanket.
3. Below 20° F: Heat grout materials to 90° F so grout has in-place temperature of 70° F at end of work day. Cover at end of work day with weather-resistive membrane and 1" thick insulating blanket or maintain heated enclosure to 40° F for a period of 48 hours.
    a. Grout Containing Type III Cement: Maintain 40° F temperature for 24 hours.

1.08 HOT WEATHER CONSTRUCTION

A. Protect masonry construction from direct exposure to wind and sun when erected in an ambient air temperature of 90° F., or greater in shade with relative humidity less than 50%. Provide artificial shade and wind breaks and use cooled materials as required. Provide artificial shade, wind breaks, use cooled materials and other

procedures outlined in BIA Tech Notes #1.

1.09 PROJECT CONDITIONS

A. Do not apply uniform floor or roof loads for at least 12 hours and concentrated loads for at least 3 days after building masonry walls or columns.

1. Brace unsupported and newly laid masonry walls. Maintain bracing in place until building structure provides permanent bracing.

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 become in contact with such masonry.

1. Protect base of walls from rain-splashed mud and from mortar splatter by coverings spread 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 on completed masonry.

PART 2 PRODUCTS

2.01 CLAY MASONRY UNITS

A. General: Provide materials that comply with Project Sustainable Design Requirements and Low Emitting Material goals.

B. Face Brick

1. Reference: Select exterior building brick conforming to ASTM C216, Grade SW.
2. Size and Color: Standard size and of a color range and texture selected by the Architect.
3. Manufacturer/Color
   a. GLEN GERY Sunset Flashed Ironspot
   b. GLEN GERY Iron Ridge Velour
   c. Other Manufacturers: Brick by other manufacturers may be used providing the above requirements are met or exceeded. Color and texture must be ~~equal~~ as approved by the Architect prior to bid.
4. Special Shapes: Provide solids, shelf angle bricks and other special shapes as indicated or required so as no brick cores are exposed to view. Color and texture to match face brick or accent brick as applicable.

2.02 CONCRETE MASONRY UNITS

A. General

1. Curing: Cure for at least 7 days and units must be at least 28 days old

when used in the work.

2. Corners (Interior Walls): Provide bullnose edges at all outside corners unless otherwise indicated or directed.
3. Integral Water Repellents: Use in units exposed to weather. Amount as recommended by water repellent manufacturer as approved by concrete block manufacturer.
    a. Type: Liquid polymeric, integral water-repellent admixture that does not reduce flexural bond strength. Units made with integral water repellent, when tested according to ASTM E 514 as a wall assembly made with mortar containing integral water-repellent manufacturer's mortar additive, with test period extended to 24 hours, shall show no visible water or leaks on the back of test specimen.
    b. Products/Manufacturers: Subject to compliance with requirements, provide W. R. GRACE Dry-Block; MASTER BUILDERS' INC. Rheomix-Rheopel; ACME-HARDESTY CO. Acme-Shield; KRETE INDUSTRIES KreteControl 202 Internal Water Repellent; EUCLID CHEMICAL Hydrapel System.

B. Hollow Load Bearing, Solid Load Bearing (75%) and Fire Resistant Concrete Masonry Units

1. Type: Hollow, load bearing, standard modular size and shapes, thoroughly cured and dried.
2. References: ASTM C90.
3. Unit Compressive Strength: Provide units with minimum average net-area compressive strength of 1900 psi.
4. Weight Classification: Normal weight, unless otherwise indicated.
5. Linear Shrinkage: Not to exceed 0.065 percent, ASTM C426.
6. Aggregate: ASTM C33 normal weight aggregates. Cinder aggregates not permitted.
7. Fire Resistant
    a. Rating: Design for fire ratings indicated on drawings.
    b. Manufacturer
        1) Listed in the Building Materials List published by the Underwriters' Laboratories, Inc.
        2) In lieu of above, provide a report from a nationally recognized testing agency stating that the units are equivalent in fire rating to those furnished by the producers as listed above.

2.03 MORTAR

A. Materials

1. Portland Cement: ASTM C150, Type I or II, except Type III may be used for cold-weather construction. Provide natural color or white cement as required to produce mortar color indicated or selected.
2. Masonry Cement: ASTM C91, provide non-staining type for stonework.
3. Hydrated Lime: ASTM C207, Type S.

4. Aggregate: ASTM C144, clean masonry sand, not over 10% to pass No. 100 sieve for general use.
5. Water: Clean, fresh and free of deleterious amounts of acids, alkalis and foreign organic matter.
6. Water Repellent Admixture: W. R. GRACE Dry-Block, RHEOMIX - Rheopel Mortar Admixture; MASTER BUILDERS, INC., KRETE INDUSTRIES KreteGuard 390. Manufacturer must submit certification that water repellent admixture meets or exceeds requirements specified herein.
   a. Conformance: ASTM E514.
   b. Type: Integral polymeric water-repellents (IPWR).
7. Color Additive: Inorganic pigments as required to produce colored mortar as selected by Architect. SGS Colors by SOLOMON GRIND CHEM SERVICE; DAVIS COLORS ~~or equal~~.
   a. Resistant to alkali, light and weather
   b. Unaffected by cement and free of water soluble salts.
8. Cold Weather Additive: Non-chloride, non-corrosive, accelerating admixture complying with ASTM C494, Type C or ASTM C1384 and recommended by the manufacturer for use in masonry mortar of composition indicated.

B. Proprietary Mortar Cement: Conform to ASTM C91, containing hydrated lime.

1. Certification: Submit certified laboratory data substantiating conformance with structural requirements for mortars as specified; and that no adverse chemical reaction will occur with the specified masonry accessories and reinforcing. Certification must be received and approved by Architect prior to mortar use.
2. Suitable products are acceptable from the following manufacturers:
   a. MIAMI
   b. LEHIGH HANSON
   c. ESSROC MATERIALS, INC. (Brixment)
   d. QUIKRETE
   e. CEMEX INC.

C. Mixes - Unit Masonry

1. Provide water repellent admixture in all mortar used for exterior CMU masonry work. Add to mix in accordance with manufacturer's recommendations.
2. Type M Mortar
   a. Use: Provide for CMU work below grade or in contact with earth.
   b. Proportions: ASTM C270 proportions by volume. Minimum average compressive strength at 28 days of 2,500 psi.
   c. Color: Natural color.
3. Type S Mortar
   a. Use: Provide for all CMU work.
   b. Proportions: ASTM C270 proportions by volume. Minimum average compressive strength at 28 days of 1,800 psi.

4. Type N Mortar
    a. Use: Provide for brick veneer.
    b. Proportions: ASTM C270 proportions by volume. Minimum average compressive strength at 28 days of 750 psi.
    c. Colors: As selected by Architect.

2.04 GROUT

A. Masonry Grout - Mix

1. Fine Grout for Reinforced Masonry: Mix with mechanical mixer with sufficient water to the desired consistency in accordance with ASTM C476 Proportion Specifications.
    a. Portland Cement: 1 part
    b. Hydrated Lime: 0 to 1/10 part
    c. Fine Aggregate: 2-1/4 to 3 times the sum of the volumes of the cementitious materials
2. Coarse Grout for Reinforced Masonry: Mix with mechanical mixer with sufficient water to the desired consistency in accordance with ASTM C476 Proportion Specifications.
    a. Portland Cement: 1 part
    b. Hydrated Lime: 0 to 1/10 part
    c. Fine Aggregate: 2-1/4 to 3 times the sum of the volumes of the cementitious materials.
    d. Coarse Aggregate: 1 to 2 times the sum of the volumes of the cementitious materials.
3. Hand Mixing: Not acceptable.

2.05 REINFORCING

A. Manufacturers: DUR-O-WALL; HECKMANN BUILDING PRODUCTS; HOHMANN & BARNARD; MASONRY REINFORCING CORPORATION OF AMERICA (WIREBOND). Where products are specified referencing a particular manufacturer, ~~equal~~ products from the manufacturers listed are acceptable providing the product meets the requirements indicated.

1. Where a manufacturer is listed below for a specific product, it is to establish a level of quality. Similar products of ~~equal~~ quality from the above listed manufacturers are acceptable.

B. Horizontal Joint Reinforcement

1. General
    a. Type: Ladder type, standard weight, galvanized.
    b. Width: Approximately 2 in. less than nominal wall thickness.
    c. Spacing: Continuous along horizontal joint, spaced 16 inches on center vertically, unless otherwise indicated.
2. Longitudinal Wire
    a. Single Wythe Walls: 2 wires.

C. Metal "Z" Ties: 3/16" galvanized steel "Z" shaped wire ties, 2" narrower than wall width. For use in block wythes at control joints.

D. Adjustable Veneer Anchor

1. Steel Stud or Structural Steel Back-Up: Two piece, adjustable loop type anchor and tie. Anchors and ties shall be carbon steel, devices, hot dip galvanized after fabrication, coating conforming to ASTM A153, Class B2, 1.5 ounce coating per square foot. Manufacturer to provide oversized hole as required to accommodate diameter of screws without abrasion of zinc coating.
   a. Anchor
      1) Steel Stud Back-Up: Screw-on galvanized steel strap anchor, 12 gage by 3/4" wide by 9" long with 3/8" offset and 4" adjustment. Provide strap with 3/8" hole at each end for fasteners. Provide self-tapping carbon steel screws with minimum 0.0005" of zinc coating. HECKMANN 315-C.
      2) Steel Stud/ Sheathing Back-Up: Screw-on galvanized steel strap anchor with stand-off legs for insulation sheathing board in depths required. X-SEAL by HOHMANN & BARNARD or similar type design manufactured by HECKMANN, AA WIRE PRODUCTS, DUR-O-WAL, INC., NATIONAL WIRE PRODUCTS INDUSTRIES. Seal insulation face with reinforced polyolefin base, laminated to a polypropylene layer tape. Alternate design attachment must be specifically designed for insulated sheathing in depths required.
      3) Structural Steel Back-Up: Weld-on steel strap anchors. Field prime after welding. 12 gage by 1/2" wide by 8' long with six 3/8" offsets to provide 7-3/4" vertical adjustment. HECKMANN 317-B.
      4) Fasteners: Hot-dipped galvanized steel bolt, nut and washer.
   b. Ties: Triangular tie, fabricated from 3/16" diameter galvanized cold drawn steel wire. Provide ties long enough to engage the anchor and be embedded not less than 2" into the bed joint of the masonry veneer. HECKMANN 316 Series.

F. Wire Mesh: Wire Mesh: 1/4" mesh of galvanized steel wire (min. 16 gage) or galvanized metal lath, cut into strips 1-1/2" narrower than wall width where used. For use at intersection of masonry walls.

G. Reinforcing Steel - Bond Beam and Wall Reinforcement: Uncoated steel reinforcing bars; ASTM A615/A; ASTM A616, including Supplement 1; or ASTM A617/A, Grade 60.

2.07 MISCELLANEOUS ITEMS

A. Through-Wall Flashing: Provide one of the following types:

1. Copper Composite
   a. Characteristics:
      1) Type: Copper core with polymer fabric laminated to copper face on both sides with non-asphalt adhesive.
      2) Copper: ASTM B370, CDA Alloy 110
      3) Weight: 5 oz
      4) Fabric: polymer fabric; laminated both faces of copper core.
   b. Mastic/sealant: One part 100% solids, solvent-free formulated silyl-terminated polyether (STPE), ASTM C920, Type S, Grade NS, Class 50.
   c. Termination Strip: Provide type recommended by flashing manufacturer.
   d. Manufacturers/Products
      1) YORK MANUFACTURING, INC.; Multi-Flash
      2) STS COATINGS, INC.; Gorilla Flash GF-500
      3) WIRE-BOND, INC.; Copper Seal
      4) ADVANCED BUILDING PRODUCT; Copper Sealtite
2. Rubber Sheet
   a. Material: Self-adhesive, cold-applied sheet consisting of 32 mil rubberized asphalt bonded to 8 mil polyethylene film. Provide with release film.
   b. Mastic: Rubberized asphalt-based mastic.
   c. Surface Primer (Conditioner): Type as recommended by manufacturer.
   d. Manufacturer: Perm-A-Barrier by W. R. GRACE, Sando-Seal by SANDELL MANUFACTURING COMPANY, IPCO Wall Flashing; ILLINOIS PRODUCTS CORPORATION, CCW 705 TWF; CARLISLE COATINGS AND WATERPROOFING, POLYGUARD 400 TWF, ADVANCED BUILDING PRODUCTS Strip –N -Flash
3. Stainless Steel Core Flexible Flashing with Drainage Fabric (SSCFF).
   a. Material: Composite with stainless steel with adhesive polymer fabric laminated to one stainless steel and non-woven drainage fabric laminated to opposing face with adhesive.
      1) Stainless steel: type 304, ASTM A240
      2) Polymer fabric; laminated back face to stainless steel core.
      3) Non-woven drainage fabric: Fabric laminated to front face stainless steel core.
   b. Manufacturer: YORK MANUFACTURING, INC.; York Flash-Vent SS, STS COATINGS, INC.; Wall Guardian Venting Stainless Steel TWF, BUILDING MATERIALS WEST COMPANY, INC.; Evacu-Flash SS
   c. Note: Eliminate cavity protection material if SSCFF used.
   d. Note: Eliminate drip edge by terminating at brick face and sealing down the flashing if SSCFF used. However, provide drip edges above windows and doors for replacement ease.

B. Sheet Metal Drip Edge: Fabricated from 0.015” thick by minimum 3” wide stainless steel with hemmed edge. Comply with requirements specified in Section 07 62 00 - Flashing and Sheet Metal.

1. Product: HECKMAN BUILDING PRODUCTS, IPCO stainless steel drip edge, ILLINOIS PRODUCTS CORPORATION or HOHMANN & BARNARD, INC.

C. Preformed Masonry Control Joint Filler

1. General: Extruded rubber complying with ASTM D2240, general purpose grade.
2. Flange: Where applicable, locate as required for the particular joint configuration.
3. Manufacturer: Rapid Regular Control Joint by DUR-O-WALL; HOHMANN & BARNARD, ~~or equal.~~

D. Cell Vent: Polypropylene Model #QV Quadro Vent by HOHMANN & BARNARD; Model D/A 1006 by DUR-O-WALL or ~~equal~~ by HECKMANN. Color as selected by Architect.

E. Reinforcing Bar Positioners: Wire units designed to fit into mortar bed joints spanning masonry unit cells with loops for holding reinforcing bars in center of cells. Units are formed from 0.142" steel wire, hot-dipped galvanized after fabrication.

1. D/A 811 DUR-O-WALL
2. D/A 816 DUR-O-WALL
3. No. 376 Rebar Positioner HECKMAN
4. #RB Rebar Positioner HOHMANN & BARNARD
5. #RB-Twin Rebar Positioner HOHMANN & BARNARD
6. Double O-Ring Rebar Positioner MASONRY REINFORCING CORPORATION OF AMERICA
7. O-Ring Rebar Positioner MASONRY REINFORCING CORPORATION OF AMERICA

F. Cavity Protection Material: Minimum 1" thick, reticulated, nonabsorbent mesh, made from polyethylene strands and shaped to maintain drainage at weep holes without being clogged by mortar droppings.

1. Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
   a. Mortar Net; MORTAR NET USA, LTD.
   b. Mortar Break; ADVANCE BUILDING PRODUCTS
   c. Mortar Net; MASONRY REINFORCING CORPORATION OF AMERICA.
   d. Mortar Net; HOHMANN & BARNARD, INC.
   e. CavClear Masonry Mat; ARCHOVATIONS
   f. Mortar Stop; POLYTITE MANUFACTURING CORP.
   g. Mortar Grab: IPCO PRODUCTS.

PART 3 EXECUTION

3.01 INSPECTION

A. Examine the substrates, structure, and installation conditions. Do not proceed with unit masonry work until unsatisfactory conditions are corrected.

3.02 PREPARATION

A. Brick

1. Wet brick having ASTM C67 absorption rates greater than 0.025 oz. per square inch per minute. Use wetting methods which ensure that each masonry unit is nearly saturated, but surface dry when laid. During freezing weather, comply with the recommendations of BIA.
2. Except for absorbent units specified to be wetted, lay masonry units dry.

B. Concrete Masonry Units: Lay masonry units dry. Do not wet concrete masonry units.

C. Establish lines, levels, and coursing.

D. Coordination: Identify items that are to be built-in to masonry wall as specified in other section of these specifications. Verify that these items are available prior to commencing masonry work in these areas. Coordinate sizes of required openings. Items include, but are not necessarily limited too:

1. Access doors
2. Recessed fire extinguisher cabinets
3. Recessed toilet accessories

3.03 INSTALLATION - GENERAL

A. Build walls to the full thickness shown. Build single wythe walls to the actual thickness of the masonry units, using units of nominal thickness shown or specified.

B. Cut masonry units using motor-driven masonry saws to provide clean, sharp, unchipped edges. Cut units as required to provide pattern shown and to fit adjoining work neatly. Use full-size units without cutting wherever possible. Provide 100% solid units where webs would be exposed.

C. Construction Tolerance: Comply with tolerances in ACI 530.1/ASCE 6/TMS 602 and the following:

1. For conspicuous vertical lines, such as external corners, door jambs, reveals, and expansion and control joints, do not vary from plumb by more than ¼" in 20 feet, nor ½" maximum.
2. For vertical alignment of exposed head joints, do not vary from plumb by more than ¼" in 10 feet, nor ½" maximum.
3. For conspicuous horizontal lines, such as exposed lintels, sills, parapets, and reveals, do not vary from level by more than ¼" in 20 feet, nor ½" maximum.

4. For exposed bed joints, do not vary from thickness indicated by more than plus or minus 1/8”, with a maximum thickness limited to ½”. Do not vary from bed-joint thickness of adjacent courses by more than 1/8”.
5. For exposed head joints, do not vary from thickness by more than plus or minus 1/8”. Do not vary from adjacent bed-joint and head-joint thicknesses by more than 1/8”.

D. Openings: Form all chases and openings required for piping and other trades. After work is completed, close openings with masonry and seal around penetration.

E. Seal all anchor penetrations and tears in the vapor barrier as a result of the work installed under this section.

3.04 ERECTION - BRICK AND CONCRETE MASONRY

A. Masonry

1. Layout walls in advance for accurate spacing of surface bond patterns, with uniform joint widths, and to properly locate returns and offsets. Avoid the use of less than half-size units at corners, jambs and other locations.
2. Lay up walls plumb and true to comply with specified tolerance. Provide courses level, accurately spaced and coordinated with other work.
3. Pattern Bond: Lay exposed masonry in running bond with vertical joint in each course centered on units in courses above and below. Bond and interlock each course of each wythe at corners. Do not use units with less than 4" of horizontal face dimensions at corners.
4. Lay hollow concrete masonry units with full mortar coverage on horizontal and vertical face shells. Bed webs in mortar in starting course on footings and slabs. Maintain 3/8" joint widths, except for minor variations required to maintain bond alignment.
5. Joints
   a. Exposed: Cut flush and finish (tool) with hardened metal tool to form a concave compressed joint. Same methods and types of tools to be used by all masons working on project.
   b. Concealed: Cut flush and trowel point.
6. Compress and cut joints flush for masonry foundation walls.
7. Lay brick masonry units with completely filled bed and head joints. Butter ends with sufficient mortar to fill head joints and shove into place. Do not slush head joints.

B. Horizontal Wall Reinforcement: Provide continuous masonry joint reinforcement as indicated. Install entire length of longitudinal side rods in mortar with a minimum cover of 5/8 inch on exterior side of walls, 1/2 inch elsewhere. Lap reinforcement a minimum of 6 inches.

1. Space reinforcement not more than 16 inches o.c.
2. Space reinforcement not more than 8 inches o.c. in foundation walls and parapet walls.
3. Provide reinforcement not more than 8 inches above and below wall

openings and extending 12 inches beyond openings.
   a. Reinforcement above is in addition to continuous reinforcement.
4. Cut or interrupt joint reinforcement at control and expansion joints, unless otherwise indicated.
5. Provide continuity at corners and wall intersections by using prefabricated "L" and "T" sections. Cut and bend reinforcing units as directed by manufacturer for continuity at returns, offsets, column fireproofing, pipe enclosures, and other special conditions.
6. Provide additional reinforcement continuous in first joint above openings and in first joint below openings not extending to floor. Extend additional reinforcement a minimum of 4'-0" beyond opening.

C. Brick Veneer/Metal Stud Wall Ties: Install in accordance with manufacturer's instructions. Locate one tie per every two square feet of wall surface and in accordance to BIA Technical Notes No. 44B.

D. Cavity Wall Construction

1. Keep the air space clear and clean of all mortar droppings and other debris.
2. Provide weeps spaced 24 inches apart.
3. Provide cavity drainage protection or similar methods to ensure that weeps are clear of mortar droppings and drain to the building exterior.
4. Make weep holes by methods subject to Architect's approval
   a. Gray Mortar: Louvered PVC weep, similar to HOHMANN & BARNARD #343 located in brick head joints.
   b Colored Mortar: Cellular weep vents located in brick head joints.
   c. Tube and Cotton Wick: Medium Density Polyethylene
5. Provide top of wall weep ventilation with cellular vent.

E. Door Frames: Fill all frames installed in masonry with mortar.

F. Control and Expansion Joints: Provide control joints for exterior and interior masonry construction in accordance with NCMA-TEK Bulletins 10-1A and 10-2B and BIA Technical Notes 18B.

1. Unless otherwise indicated, provide control joints in masonry walls at maximum 24 foot intervals for exterior walls, maximum 30 foot intervals for interior walls, and at intersections of walls, except corners.
   a. Exact locations as determined by the Architect if not specifically dimensioned.
   b. If drawings do not indicate all control joints based on these maximums, allow for additional joints to be determined by the Architect prior to commencement of masonry work.
   c. Locate control at steel columns.
2. Provide 3/8" wide control joints, unless otherwise indicated. For joints in exterior walls, build in control joint filler strips as masonry wall is laid up allowing 3/4" for sealant and backup on each side of wall. For interior control joints, no filler is required; rake joint approximately 3/4" deep and install sealant and backup. See Section 07 92 00, Sealants.

3. Do not carry horizontal joint reinforcement through control joint.
4. Maintain lateral support of continuous wall at control joint in concrete block backup walls by using control joint filler, tongue and groove type control joint block, or similar type approved method. In cavity walls, place metal “Z” wall ties 16" on-center vertically in brick on each side of control joint.
5. Maintain lateral support of intersecting interior masonry walls with wire mesh ties placed across joint between walls, spaced 16" on-center vertically.

G. Thru-Wall Flashing

1. Provide at the following locations:
   a. In first course above steel supports and shelf angles.
   b. In first course above lintels at louvers, windows and doors.
   c. In first course above grade around entire building perimeter.
   d. In exterior walls that project above adjacent lower roof.
   e. Below sills of window, louver and similar type wall openings.
   f. Below parapet wall caps.
   g. Other through wall flashing conditions where indicated.
2. Ensure that flashings drain to exterior.
3. Prepare masonry surfaces smooth and free of projections which could puncture flashing.
4. Lay on slurry of fresh mortar and cover with mortar.
5. End Dams: Provide end dams at all locations where flashing terminates within a wall. Over openings, carry minimum 6" beyond end of steel lintel and turn up edges to form pan. All corners folded, not cut.
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. Top Edge Concealed Terminations: 8 inch minimum above drainage plane.
8. Seal around all penetrations with mastic before covering with mortar.
9. Joints
   a. Install in longest lengths and with fewest joints possible but not less than 20 feet between joints.
   b. Lap ends minimum 6 inches and seal with full bed of mastic.
10. Continue flashings around corners and other gaps in shelf angles to prevent discontinuity.
11. Continue flashing through expansion joints.
12. Provide weeps at all thru-wall flashing locations. Space weeps as specified hereinbefore.

H. Place cavity drainage material in cavities to comply with configuration requirements for cavity drainage material specified herein.

I. Stopping and Resuming Work: In each course, rack back one-half-unit length for one-half running bond or one-third-unit length for one-third running bond; do not tooth. Clean exposed surfaces of set masonry, wet clay masonry units lightly if required, and remove loose masonry units and mortar before laying fresh masonry.

M. Built-in Work: As construction progresses, build in items specified under this and other Sections of the Specifications. Fill in solidly with masonry around built-in items.

3.05 MORTAR

A. General

1. Batch Size: Controlled so that all material used within two (2) hours.
2. Mortar on Board
   a. Keep well tempered with water so long as its cementing material has not started to set.
   b. Do not retemper if initial set of cementing material has been reached, or if mortar has stiffened greatly.
3. Anti-freeze Admixture: Not permitted.
4. Water Repellent Admixture: Use with brick and concrete block exposed to exterior, mix as recommended by manufacturer.

B. Mixing

1. Machine mix dry in a batch mixer with care taken in adding water to mix to avoid overwetting.
2. Do not retamper in mixer at any time.
3. Continue mixing for a minimum of five (5) minutes after all materials are in mixer.

C. Recharging: Completely empty and clean mixer before recharging.

3.06 PROTECTION

A. Brace all walls while in green condition.

B. 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 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.

3.07 REINFORCED MASONRY INSTALLATION

A. Placing Reinforcement: Comply with requirements of ACI 530.1/ASCE 6/TMS 602.

1. General: Clean reinforcement of loose rust, mill scale, earth, ice or other materials which will reduce bond to mortar or grout. Do not use reinforcement bars with kinks or bends not shown on drawings or final

shop drawings, or bars with reduced cross-section due to excessive rusting or other causes.

B. Grouting: Do not place grout until entire height of masonry to be grouted has attained sufficient strength to resist grout pressure.

1. Comply with requirements of ACI 530.1/ASCE 6/TMS 602 for cleanouts and for grout placement, including minimum grout space and maximum pour height.
2. Use "Fine Grout" per ASTM C 476 for filling spaces less than 4" in one or both horizontal directions.
3. Use "Coarse Grout" per ASTM C 476 for filling spaces 4" to 10" in both horizontal directions.
4. Use 3000 psi concrete for filling spaces 10" or larger in both horizontal directions.

C. Reinforced Concrete Masonry Walls: Install and align grout block units to provide continuous vertical voids in walls. Install reinforcing steel as work progresses. Use horizontal bars to position vertical bars. Fill grout block units cores solid with concrete fill.

1. Place concrete fill in maximum 4’-0” vertical lifts. Recess top of fill minimum 1-1/2” below top of course to form a key with the following lift. Comply with NCMA TEK Bulletins 3-2, 3-3A and 14-2 recommendations.
2. Coordinate placement of reinforcement and concrete fill with cast-in-place concrete and precast concrete work to provide continuous vertical and horizontal reinforcement full height of indicated walls.

3.08 REPAIR, POINTING AND CLEANING

A. Remove and replace masonry units that are loose, chipped, broken, stained, or otherwise damaged. Provide new units to match adjoining units and install in fresh mortar pointed to eliminate evidence of replacement.

B. During the tooling of joints, enlarge all voids or holes, and completely fill with mortar. Point up all joints at corners to provide a neat, uniform appearance.

C. Cleaning - Brick Masonry: Clean all exposed brick masonry. Cleaning agents and methods subject to Architect's approval. Protect all stone. Damaged materials and work replaced at Contractor's expense.

1. Before full-scale application, review manufacturer's product data sheets to determine the suitability of each product for the specific surfaces. Apply each masonry cleaner to test panel areas to determine dilution rates, dwell times, number of applications, compatibility, effectiveness, application procedures, effects of pressure rinsing, and desired results.
2. Apply masonry cleaners and stain removers to test panels in accordance with manufacturer's written instructions. Allow 48 hours or until test panels are thoroughly dry before evaluating final appearance and results. Do not begin full-scale application until test panels are inspected and approved by

the Architect.

3. Test Area Requirements:
   a. Size: Minimum 5 feet by 4 feet each.
   b. Locations: As determined by the Architect.
   c. Masonry Cleaners: Number of test panels as required to completely test each masonry cleaner with each type of substrate to be cleaned.
4. Test all cleaning effluents generated by the masonry cleaning of the test panels to determine any hazardous characteristics. Comply with applicable federal, state, and local environmental regulations including testing, handling, treatment, containment, collection, transport, disposal, and discharge of hazardous wastes.
5. Muratic acid cleaning of brick masonry not permitted. Install and protect installed brick masonry so that acid cleaning is not required at completion of the work.

END OF SECTION

SECTION 07 41 13

METAL ROOF PANELS

PART 1 GENERAL

1.01 WORK INCLUDED

A. Provide double locking metal standing seam roofing system complete, including prefabricated roof sheets, panel clips, insulation, fasteners, fascia cladding, flashing, trim, gutters, snow guards and accessories as required for a watertight installation.

1.02 RELATED SECTIONS

A. Sustainable Design Requirements: Section 01 81 13.

B. Nailable Roof Insulation: Section 07 22 10.

C. Sealant: 07 92 00.

D. Membrane Roofing at Gutters and Drainage: Section 07 54 23.

1.03 REFERENCES

A. Standards

1. American Society for Testing and Materials (ASTM).
   a. B209: Aluminum Alloys Sheet and Plate.
   b. A792: Steel Sheet, Aluminum-Zinc Alloy Coated by the Hot-Dip Process, Structural Quality, minimum 50,000 psi yield strength in appropriate gage.
2. National Roofing Contractors Association (NRCA).
   "The NRCA Construction Details".
3. Sheet Metal and Air Conditioning Contractors National Association (SMACNA)
   "Architectural Sheet Metal Manual".
4. American Iron and Steel Institute
   "Light Gage Cold-Formed Steel Design Manual".
5. American Architectural Manufacturers Association (AAMA)
   a. AAMA 2605; Voluntary Specification, Performance Requirements and Test Procedures for Superior Performing High Performance Organic Coatings on Architectural Extrusions and Panels.

1.04 SUBMITTALS

A. Product Data: Submit manufacturer's literature for all items. Data to fully explain product indicating materials, sizes and finishes, and installation procedures.

B. Sustainable Design Documentation Submittals: Comply with Section 01 81 13.

1. VOC Limits: Include documentation verifying product Low Emitting Material Building Product Disclosures and Optimization.

C. Shop Drawings: Submit for all items. Include the following:

1. Panel profile and gage.
2. Erection layout.
3. Special framing details.
4. Flashing details.

D. Samples: Submit minimum 9 inch long by full width sample showing finish, pattern, color, gage and profile.

E. Certification

1. Submit written evidence from manufacturer of roofing system that installer is approved by manufacturer for installation of specified roofing system.
2. Submit copies of production quality control test and written assurance from an officer of manufacturer that materials furnished for the project are the same type and dimension as that produced for tests.

F. Submit invoices and documentation from manufacturer of the amounts of post-consumer and post-industrial recycled content by weight for products with specified recycled content.

1.05 QUALITY ASSURANCE

A. Manufacturer Qualifications and Responsibilities

1. Minimum 10 years experience in architectural roofing; and roof panel supplied shall have been in use for a minimum 10 years.
2. Review and comment to Architect on shop drawings submitted.

B. Installer Qualifications: Approved and authorized by roofing manufacturer.

1. Provide supervisory personnel trained by roofing manufacturer in the proper application of product with a minimum related experience of 10 years.

2. All Other Personnel: Minimum 5 years experience in sheet metal roofing with previous experience in comparable size projects.

C. Wind Uplift: Meet or exceed requirements of U.L. for Class 90 Wind Uplift Resistance.

D. Water Infiltration Under Static Pressure: Tested with sidelap sealant per ASTM E1646.

1. No leakage through panel joints at 12.0 psf.

E. Air Infiltration: Tested in accordance with ASTM E1680.

1. 0.006 cfm per linear foot of joint at static test pressure differential of 20.00 psf.

F. Wind Uplift Classification: The panel system shall be listed as a Class 90 windstorm rated system, as determined by UL 580.

G. Painted Finishes: Factory painted finish to be performed by an applicator specifically approved by the paint manufacturer. The applicator shall provide written notification of approval by paint manufacturer prior to application of the finish.

1.06 HANDLING AND STORAGE

A. Exercise care so as not to damage or deform materials.

B. Stack on platforms or pallets and cover to protect from weather.

C. Provide anti-stick compound or ply on finished surfaces to protect finish. Compound or ply shall be readily removable type with no adverse effects on finish.

1.07 WARRANTY

A. Prior to completion of project, submit copies of the following:

1. Panel manufacturer's 20 year warranty against structural defects and corrosion.
2. Installation Contractor's 2 year guaranty on workmanship and watertightness.
3. Provide manufacturer's guarantee of paint finish against failure of paint finish. Failure includes blistering, peeling, cracking, flaking, checking, excessive color change and chalking. Color change shall not exceed 5 N.B.S. units (per ASTM D523) and chalking shall not less than a rating of 8 per ASTM D4214.
   a. Warranty Period: 20 years.

PART 2 PRODUCTS

2.01 MATERIALS

A. General: Provide factory-formed metal roof panels designed to be installed by lapping and interconnecting raised side edges of adjacent panels with joint type indicated and mechanically attaching panels to supports using concealed clips in side laps. Include clips, cleats, bearing plates, sealants and accessories required for weathertight installation.

B. Roofing Sheets: 0.0276” aluminum-zinc alloy-coated steel sheet, 50,000 psi minimum yield, structural grade 50A, coating designation AZ60 per ASTM A792.

1. Texture: Smooth.

C. Joints: Standing rib, approximately 1-3/4 to 2", 16” to 18” on center, with continuous groove capillary break. Securely lock ribs over concealed anchor clips with field applied mechanically sealed seam cover strips.

D. Panel Length: Full length from ridge to eaves (or flashing break to flashing break). No end joints permitted in the field of a span length.

E. Finish: Fluoropolymer finish containing not less than 70% PVDF (Kynar 500) resins; "Trinar" by AKZO; "Duranar" by PPG; "Fluropon" by VALSPAR. Total dry film thickness not less than 1.0 mils, or coatings meet or exceed the requirements of AAMA 621.

1. Color: As selected by Architect from paint manufacturer’s complete specified line.
2. Application: Apply coating systems in strict accordance with manufacturer's printed instructions and recommendations. Refer to Quality Assurance in Part 1.

2.02 ACCESSORIES

A. Flashing, Trim and Accessories: Same material and finish as roofing panel. Gage of various components as designed by roofing manufacturer to meet design conditions encountered. Fabricate to profiles indicated.

1. Flashing and Counterflashing: 0.0276”.
2. Gutters and Downspouts: 0.0396”.
3. Downspout Straps: 0.0635”.
4. Gutter Brackets and Supports: 0.0635”.
5. Fascia: 0.0396”.
6. Others: 0.0276”.

B. Roof Anchor Clip: Non-magnetic stainless steel. Fasteners installed in these clips shall be fully recessed so that no sharp edges come in contact with the roof material. Clips shall be designed to allow for expansion and contraction of the roof relative to the structure throughout the temperature range specified.

1. Anchor clip attachment to structure: Fastener type and size as recommended by roofing manufacturer. Allow for thermal movement.

C. Exposed Flashing Fasteners: #300 stainless steel. For weathertightness, screws shall have separate washers with hot bonded neoprene faces and pop-rivets shall be set in wet sealant. Exposed fasteners shall be a minimum #14 size screw or 3/16" rivet. Locate fasteners so that leakage does not run directly inside the structure.

D. Closures: Precut foam profile closures cut from a black closed cell foam meeting specification ASTM D1056 grade SCE-41 Black EPT. Field fabricated hip closures shall be gray PVC foam. All hip and ridge closures shall be supported and protected from weathering by a channel matching the roof and flashing.

E. Underlayment: Provide under entire metal roof surface.

1. Material: Polyethylene sheet backed rubberized asphalt membrane, 40 mils thick. Provide primer as recommended by membrane manufacturer.
2. Manufacturers: Bituthene Ice and Water Shield by W.R. GRACE; Polyken 640 Underlayment Membrane by POLYKEN TECHNOLOGIES; Polyguard Deck Guard by POLYGUARD PRODUCTS; Weather Watch by GAF; Winterguard by CERTAINTEED.

F. Sealant used with the roofing shall be applied between surfaces during assembly with a minimum amount exposed on the completed installation.

1. Concealed sealant shall be a non-curing polyisobutylene tape of sufficient thickness to make full contact with both surfaces.
   a. Panel Seams: Provide Factory Applied Non-Curing Sealant.
2. Exposed Sealant: Urethane elastomeric type with excellent weathering and sunlight resistance. See Section 07 92 00.
   a. Color: Match prefinished exterior metal.
   b. Apply sealant in accordance with manufacturer's recommendations.

G. Snow Guards: Non - penetrating bar clamp and fence type consisting of clamp to seam bracket, tubing, tubing couplers, tubing caps, tubing collars and ice stops.

1. Bracket: 2 piece extruded aluminum approximately 4”long x 2.5” wide and 5” tall with 2 tubing holes for high pith and 1 hole for low pitch roofs.
2. Tubing: 6061-T6 aluminum with 1” outside diameter and .0125 wall thickness.
3. Tubing Couplers: 6061-T6 Aluminum shaft with stainless washers and tightening bolts, nylon slip washers and rubber expansion washers.
4. Tubing Caps: 302 stainless steel
5. Tubing Collars: 6061-T6 aluminum with stainless steel set screws.
6. Ice Stops are 601-T6 aluminum with stainless fasteners.
7. Manufacturers: S-5! by ROCKY MOUNTAIN SNOW GUARDS INC. or approved **products**.
8. Finish: Match roof panels.

2.03 INSULATION

A. Polyisocyanurate Board Insulation: ASTM C1289-13 "Standard Specification for Faced Rigid Cellular Polyisocyanurate Thermal Insulation Board," Type II, glass-fiber mat facer on both major surfaces.

1. Tapered Insulation: 1/4" per foot. No slope under ¼” per foot will be permitted.
2. R-Value: Provide thickness as indicated. Coordinate with nailable roof

insulation.
3. Compressive Strength: Minimum 20 (Grade 2).

B. Provide adhesives as recommended by insulation manufacturer for substrates encountered.

C. Mechanical fasteners for attachment of insulation to decking shall be approved by the insulation manufacturer for the system specified.

1. The same brand fastener is to be used throughout the roof system.
2. Number of fasteners and layout will be as recommended by the manufacturer and as per FM Approval Guide for the specified wind uplift.

2.04 FABRICATION

A. Shop fabricate to the maximum extent practicable.

1. Brake-form to the indicated arrangement and profile with sharply defined lines and with braked shapes sharp and true. Seams, ridges and other edges and corners are straight and well aligned.
2. Tolerances: Maximum 1/16" in 8' of length (non-accumulative) and maximum 3/8" in 40' or more.
3. Flat Planes: Free of wave, warp, buckle or other deficiencies in appearance.
4. Seams
   a. Standing Seams: Straight, of uniform height and profile and without wave.
   b. Cross Seams: Lay out panels so cross seams, when required and permitted, will be made in the direction of flow with higher pans overlapping lower pans. Provide continuous sight line.

2.05 MANUFACTURER

A. Basis of Design Manufacturer: Series DL20 by DIMENSIONAL METALS INC.

B. Subject to compliance with the specified requirements, roofing systems by the following manufacturers are also acceptable:

1. ATAS.
2. CENTRIA
3. BERRIDGE
4. FIRESTONE
5. IMETCO

C. Design roofing system in accordance with the dimensions and general arrangements indicated on the drawings.

PART 3 EXECUTION

3.01 INSPECTION

A. Before installation of panels, verify that the structure is ready to receive work. Check field dimensions and alignment of structural members to assure that the roof panels and flashing are straight and true.

B. Notify Architect of conditions which may adversely affect the appearance of the installed roof; work on that location will not proceed until resolved by the Architect.

3.02 INSTALLATION

A. Erect in accordance with Drawings and manufacturer's instructions and recommendations under the direct supervision of an experienced sheet metal craftsman trained in application of metal roofing.

B. General

1. Do not allow installed work of this section to be used as a storage space for other materials.
2. Do not permit unnecessary walking on the finished roof. Require personnel to wear rubber-soled shoes when installing or walking on finished roof.

C. Erect panels true and to the slopes indicated on the drawings. Final appearance of the roof shall be visually flat, straight and free from defects and dents.

D. Install all work so as to allow for thermal movement without distortion or elongation of fastener holes.

E. Installation Tolerance: Shim and align panel units within installed tolerance of 3/8" in 40' on level/plumb/slope and location/line as indicated, and within 1/8" offset of adjoining faces and of alignment of matching profiles.

F. Install flashing in accordance with the recommended practices of AA, NRCA and SMACNA architectural sheet metal manuals, without fasteners in end laps.

G. Seal all panel/panel, panel/trim, and accessory/panel joints to provide resistance to air and water penetration.

3.03 FIELD TESTING

A. Conduct 5 random fastener pull tests in areas designated by Architect. Submit test results for comparison to design requirements.

3.04 DAMAGED PANELS

A. Do not install panels that are bent, chipped, or otherwise damaged.

B. Refinish all abraded surfaces to match original finish, using materials and methods recommended by roofing manufacturer. Materials shall be fully compatible with the original finish system.

C. Repaired surfaces shall be uniform and free from variations in color and surface texture from that of adjacent, like surfaces.

D. If repaired sheet is not acceptable to the Architect, remove sheet and replace with a new sheet, at no additional cost to the Owner.

3.05 CLEAN UP

A. Clean all roofing surfaces of dirt, grime, excess sealant and other surface blemishes.

B. Remove from the site all excess material, shipping cartons debris and etc., related to the roofing work.

3.06 PROTECTION

A. Protect installed panels from abuse by other trades.

B. Installing Contractor shall advise General Contractor of any necessities for protection from the work of other trades.

END OF SECTION

SECTION 07 92 00

JOINT SEALANTS

PART 1 GENERAL

1.01 SCOPE

A. General: Prepare joints and apply sealant or caulking at all locations which normally require sealing to prevent infiltration of air, water, and insects and to reduce transmission of sound.

B. Apply sealants to exterior and interior non-static joints. Do not seal normal drainage points or weep holes. Include the following:

1. masonry control and expansion joints
2. around louvers, exterior trim, windows, door frames, aluminum entrances and other penetrations or openings in exterior walls
3. threshold bedding
4. joints between different wall materials
5. termination in joints between wall materials and adjacent materials
6. other applications indicated

C. Sealing of joints in concrete construction, including sidewalk joints, concrete paving joints and floor joints, tile floor expansion joints and other floor joints as indicated.

D. Sealing of all exterior and interior locations where materials or equipment do not fit together or against the adjoining surface with a hairline joint.

F. Sealing between wall and wall mounted plumbing fixtures and floor and floor mounted plumbing fixtures.

G. Sealing at intersection of countertops and side/backsplashes to each other and to wall.

H. Sealing at reglets and wall and roof flashings set in sealant.

I. Seal penetrations through ceramic tile work.

J. Trim exposed masonry flashing.

J. Latex type caulking of interior static joints. Include the following:

1. intersection of exposed structure or ceiling construction with masonry walls
2. perimeter seal of metal door and borrowed light frames where they abut drywall.
3. intersection of grilles and louvers with adjacent surfaces

4. intersection of cabinets, casework and similar items applied to or recessed in walls
5. other applications indicated

K. Joints, perimeter, and penetrations in fire-rated assemblies. Use firestopping specified in Section 07 84 00.

L. Joints, perimeter, and penetrations in sound-rated assemblies. See Section 09 21 16.

1.02 RELATED SECTIONS

A. Firestopping Sealants: Section 07 84 00.

B. Sustainable Design Requirements: Section 01 81 13.

C. VOC Limits: Section 01 81 16.

1.03 GENERAL PERFORMANCE

A. Except as otherwise indicated, joint sealant is required to establish and maintain airtight and waterproof continuous seals on a permanent basis, within recognized limitations of wear and aging as indicated for each application.

B. Failures of installed sealant to comply with this requirement will be recognized as failures of both materials and workmanship.

1.04 SUBMITTALS

A. Submit manufacturer's product data and installation instructions.

1. Certification, in the form of manufacturer's standard data sheet or by letter, stating that each type of compound and sealant to be furnished complies with these specifications.
2. Statement that each product to be furnished is recommended for the application shown and is compatible with all materials to which applied.
3. Instructions for handling, storage, mixing, priming, installation, curing and protection for each type of sealant.

B. Joint-Sealant Schedule: Include the following information:

1. Joint-sealant application, joint location, and designation.
2. Joint-sealant manufacturer and product name.
3. Joint-sealant formulation.
4. Joint-sealant color.

B. Submit manufacturer's color chart for color selections.

C. Submit cured sealant samples in colors required for the work. Architect's approval will be for color only. Compliance with other requirements is the Contractor's

responsibility.

D. Sustainable Design Documentation Submittals: Comply with Section 01 81 13.

1. VOC Limits: Include documentation verifying product Low Emitting Material Building Product Disclosures and Optimization.

1.05 STORAGE AND HANDLING

A. Prevent inclusion of foreign matter or the damage of materials by water or breakage.

B. Procure and store in original containers until ready for use.

C. Materials showing evidence of damage shall be rejected.

1.06 WARRANTY

A. Installer's Warranty: Contractor and joint sealant applicator shall jointly warranty joint sealant work for two (2) years from date of final acceptance. Warranty shall include replacing joints which fail to perform as airtight; or fail in adhesion, cohesion, abrasion resistance, weather resistance, extrusion resistance, migration and stain resistance, general durability or any other form of apparent deterioration (excluding inherent qualities and limitations clearly specified in the manufacturer's submitted product data).

B. Manufacturer's Warranty: Manufacturer's standard form in which joint-sealant manufacturer agrees to furnish joint sealants to repair or replace those that do not comply with performance and other requirements specified in this Section for ten (10) years from date of final acceptance

C. Warranties specified in this article exclude deterioration or failure of joint sealants from the following:

1. Movement of the structure caused by structural settlement or errors attributable to design or construction resulting in stresses on the sealant exceeding sealant manufacturer's written specifications for sealant elongation and compression.
2. Disintegration of joint substrates from natural causes exceeding design specifications.
3. Mechanical damage caused by individuals, tools, or other outside agents.

C. Comply with these specifications for repair or replacement of work.

PART 2 PRODUCTS

2.01 GENERAL

A. Definitions:

1. The term "sealant" will be understood to be a urethane or silicone elastomeric type.
2. The term "caulk" will be understood to be a synthetic resin base of highest quality acrylic latex compound.

B. General: Provide materials that comply with Project Sustainable Design Requirements and Low Emitting Material goals.

1. Compatibility: Provide joint sealants, backings, and other related materials that are compatible with one another and with joint substrates under conditions of service and application, as demonstrated by joint-sealant manufacturer, based on testing and field experience.
2. Suitability for Contact with Food: Where sealants are indicated for joints that will come in repeated contact with food, provide products that comply with 21 CFR 177.2600.
3. Colors: As selected by Architect from manufacturer's full range; selected colors to match adjacent materials.
4. Where exposed to foot traffic, select materials of sufficient strength and hardness to withstand stiletto heel traffic without damage or deterioration of sealant system.

C. Manufacturers: BOSTIK; DOW CORNING CORPORATION; EUCLID CHEMICAL; TREMCO MANUFACTURING COMPANY; GENERAL ELECTRIC COMPANY/MOMENTIVE; SIKA CHEMICAL CO.; MAMECO INTERNATIONAL; BASF BUILDING SYSTEMS; VULCHEM.

1. Manufacturer's listed under the following applications are for basis of design. ~~Equal~~ products by above listed manufacturers are acceptable.

2.02 ELASTOMERIC MATERIALS

A. Exterior Vertical and Overhead Joints: Single-component neutral curing silicone sealant meeting ASTM C920, Type S, Grade NS, Class 50.

1. DOW 791
2. GE SCS9000 Silpruf NB
3. TREMCO Spectrum 3
4. PECORA 895 NST

B. Exterior Vertical and Overhead Joints: Single or multi-component elastomeric polyurethane sealant meeting ASTM C920, Type M or S, Grade NS, Class 50.

1. PECORA Dynatrol II
2. TREMCO Dymeric 240
3. BOSTIK Chem-Calk 500
4. PACIFIC POLYMERS INTERNATIONAL Elastothane230 LM Type II
5. POLYMERIC SYSTEMS INC. PSI-901

C. Horizontal Wearing Expansion Joints; Interior and Exterior

1. Type: Two-part polyurethane based elastomeric sealant, complying with ASTM C920, Class 25, Type M, Grade P, Use T. Self-leveling or gun grade type as recommended by manufacturer for application shown.
2. Location: For joints in exterior concrete pavements, sidewalks and interior floors.
    a. BOSTIK Chem-Calk 555-SL
    b. EUCLID Eucolastic II
    c. SONNEBORN Sonolastic SL 2
    d. TREMCO THC 900/901

D. Interior Vertical and Overhead Joints: Single-Component, Nonsag, Neutral-Curing Silicone Joint Sealant: ASTM C 920, Type S, Grade NS, Class 25, for Use NT. Do not use where painted.

1. DOW 799
2. GE SCS2000 SilPruf
3. TREMCO Spectrum 2
4. PECORA 895 NST

E. Sealants at Countertops, Backsplashes and Plumbing Fixtures: ASTM C920, Type S, Grade NS, Class 25. Provide with mildew resistive additive.

1. Sealant Colors
    a. Countertops and Backsplashes: Clear.
    b. Plumbing Fixtures: white, unless colored fixtures are selected, then sealant color shall match fixture color.
2. Manufacturers/Products
    a. DOW 786
    b. GE SCS1700 Sanitary.
    c. SONNEBORN Sonolastic Omniplus
    d. TREMCO Tremsil 600
    e. PECORA 898 Sanitary Sealant

F. Exterior and Interior Joints Subject to Water Immersion: Two-part elastomeric polysulfide sealant, meeting ASTM C920, Type M, Grade NS, Class 25.

1. SONNEBORN Sonolastic Two-Part
2. EPOXY SYSTEMS 913
3. CMI Sealtight Deck-O-Seal

2.03 LATEX CAULK

A. Caulk Joints – Interior, Static - Paintable: High quality acrylic latex compound, non-staining non-bleeding complying with ASTM C834 Type OP, Grade NF with a maximum volume shrinkage of 30%.

1. BASF BUILDING SYSTEMS; Sonolac.
2. PECORA CORPORATION; AC-20+.
3. TREMCO INCORPORATED; Tremflex 83

2.04 ACCESSORIES

A. Joint Primer/Sealer: Non-staining type, recommended by sealant manufacturer; compatible with joint forming material.

B. Joint Cleaner: Non-corrosive and non-staining type, recommended by sealant manufacturer; compatible with joint forming material.

C. Bond Breaker Tape: Pressure sensitive polyethylene or plastic tape, recommended by sealant manufacturer, to suit applications where bond to substrate should be avoided for proper joint sealant performance.

D. Joint Backing: Compressible rod stock conforming to ASTM C1330, Type B; material as approved in writing by joint-sealant manufacturer for joint application indicated, and of size and density to control sealant depth and otherwise contribute to producing optimum sealant performance

E. Solvents: Cleaning agent recommended by the manufacturer of the sealant in writing to Architect.

PART 3 EXECUTION

3.01 INSPECTION

A. Pre-Installation Meeting

1. Prior to sealant installation, and at the Contractor's direction, meet at project site to review material selections, joint preparations, installation procedures, weather conditions and coordination with other trades.
2. Include sealant installer, Contractor, Architect, manufacturer's representative and representatives of other trades or subcontractors affected by the sealant installation.

B. Examine substrates and installation conditions. Do not proceed with joint sealant work until unsatisfactory conditions have been corrected.

C. Installation constitutes acceptance of existing conditions and responsibility for satisfactory performance.

3.02 PREPARATION

A. Clean, seal and prime surfaces in accordance with manufacturer's recommendations. Confine primer/sealant to areas of sealant bond.

B. Remove dust, dirt, loose coatings, moisture and other substances which could interfere with sealant bond.

C. Remove lacquers and protective films from metal surfaces.

D. Architectural Concrete and Stone: Apply masking around joints to protect

adjacent surfaces from defacement and staining during sealing operations. Repair damaged masking until sealant is installed.

3.03 INSTALLATION

A. Apply joint sealant as late as possible in construction, preceding painting and following cleaning operations. Do not apply sealant during inclement weather conditions or when temperature is above or below manufacturer's limitations for installation.

B. Install joint sealant materials and accessories in strict accordance with manufacturer's installation instructions.

C. Set joint filler units at depth or position in joint as indicated to coordinate with other work. Do not leave voids or gaps between ends of joint filler units.

D. Install sealant backer rod, except where recommended to be omitted by sealant manufacturer for application indicated. Use rod diameter that will cause compression when installed.

E. Install bond breaker tape and where required by manufacturer's recommendations to ensure that sealants will perform as intended.

F. Apply joint sealants in uniform, continuous ribbons without gaps or air pockets, with complete "wetting" of joint bond surfaces on both sides. Fill sealant rabbet to a slightly concave surface, slightly below adjoining surfaces. At horizontal joints between a horizontal surface and vertical surface, fill joint to form a slight cove, so that joint will not trap moisture and dirt. Hand tool and finish all joints.

G. Install joint sealants within recommended temperature ranges and to depths indicated or when not indicated, as recommended by sealant manufacturer. For normal moving vertical and horizontal joints, fill joints to a depth equal to 50% of joint width, but not more than 1/2" deep nor less than 1/4" deep, measured at the center section of bead.

H. Confine materials to joint areas with masking tapes or other acceptable methods. Remove excess sealant materials promptly as work progresses and clean adjoining surfaces.

I. Masonry Flashing: Where sealant joint is in direct contact with flexible masonry flashing, trim flashing flush with face of masonry after sealant in installed and cured. Verify during this procedure that weep holes have not been compromised during sealing operations.

3.04 CLEANING

A. Upon completion, remove and dispose of masking materials; remove all excess sealing materials; clean adjacent materials of all soil and stain resulting from sealing operations.

1. Replace damaged material and material which cannot be properly cleaned.

END OF SECTION

SECTION 08 41 13

ALUMINUM-FRAMED ENTRANCES AND STOREFRONTS

PART 1 GENERAL

1.01 WORK INCLUDED

A. Work under this section includes the design of the aluminum entrance and window systems and all materials, labor and equipment for the complete installation of the work as shown on the drawings and specified herein. Work includes:

1. Aluminum entrance doors.
2. Aluminum entrance framing system for entrances and vestibule, including sidelight and transom frames as indicated.
3. Aluminum storefront and window systems.
4. Glass and glazing of the systems.
5. Hardware.
6. Anchors, fasteners, flashings, trim and accessories to complete the work.
7. Sealants required within entrance and window construction.
8. All gaskets, sealants and tapes required in final assembly of the work.
9. Installation of lock cylinders furnished under Section 08 71 10.

1.02 RELATED SECTIONS

A. Joint Sealants: Section 07 92 00.

B. Glazing: Section 08 81 00.

C. Hardware: Section 08 71 10.

D. Vapor/Air Barrier Transition Membranes: Section 07 27 26.

E. Sustainable Design Requirements: Section 01 81 13.

1.03 QUALITY ASSURANCE

A. Provide aluminum doors and framing system manufactured by a single firm specializing in the production of this type of work.

B. Installer Qualifications: Manufacturer's authorized representative who is trained and approved for installation of units required for this Project.

1.04 REFERENCES

A. American Architectural Manufacturers Association (AAMA): Voluntary Specification, Performance Requirements and Test Procedures for Superior Performing High Performance Organic Coatings on Architectural Extrusions and

Panels, AAMA 2605.

1.05 SUBMITTALS

A. Submit the following:

1. Framing system details.
2. Door details.
3. Window details.
4. Installation instructions.
5. Itemized schedule of door hardware.
6. Finish samples.

B. Tests: Submit two copies of test reports made or witnessed by an independent testing laboratory showing the results of tests conducted on previously manufactured windows of the type used on this project. The reports shall verify conformance to thermal movement, air and water infiltration and structural properties as described herein.

C. Building Shop Drawings: Include complete evaluations of all systems including doors; details and methods of anchorage; details of construction finishes; methods of assembly; location and installation of hardware and reinforcement for same; size, shape and thickness of materials; joints and connections; details of joining with other work.

1. Scale: Include typical unit elevation of each system at 1/2" scale and details at full scale where practical.

D. Product Data: Submit manufacturer's specifications for materials and fabrication of work, and instructions and recommendations for installation and maintenance. Include certified test reports showing compliance with requirements where a test method is indicated.

E. Samples: Submit samples of each type and color and finish required by this Section, on 12" sections of extrusions or formed shapes and on 6" squares of sheet/plate. Include two or more samples in each set.

1. Architect reserves right to require fabrication samples showing prime members, joinery, anchorage, expansion provisions, glazing and similar details, profiles and intersections.

F. Sustainable Design Documentation Submittals: Comply with Section 01 81 13.

1. VOC Limits: Include documentation verifying product Low Emitting Material Building Product Disclosures and Optimization.

1.05 DELIVERY, STORAGE AND HANDLING

A. Pack, deliver, handle, store and protect materials from damage in accordance with AAMA Curtain Wall #10, "Care and Handling of Architectural Aluminum"

recommendations.

1. Remove paper type wrappings when unloading.
2. Store materials inside the buildings whenever possible in clean, dry ventilated areas free of dust or corrosive fumes.
3. Stack members vertically or on edge, shim between components to provide water drainage and ventilation. Protect with adequate coverings, placed to provide adequate air circulation.
4. During installation, protect materials from lime mortar, run-off from concrete and copper, weld splatter, acids, roofing materials, solvents and abrasive cleaner.

1.06 PROJECT CONDITIONS

A. Field Measurements: Verify actual locations of structural supports for aluminum-framed systems by field measurements before fabrication and indicate measurements on Shop Drawings.

1.07 WARRANTIES

A. Submit written warranty signed by manufacturer, Contractor, and installer agreeing to repair or replace work which fails in materials or workmanship within three (3) years of the date of project acceptance.

1. Failure of materials or workmanship shall include excessive leakage or air infiltration, excessive deflections and defects in accessories, weather seals and other components of work.

B. Finish: Provide paint manufacturer's guarantee of paint finish against failure of paint finish. Failure includes blistering, peeling, cracking, flaking, checking, excessive color change and chalking. Color change shall not exceed 5 N.B.S. units (per ASTM D523) and chalking shall not less than a rating of 8 per ASTM D4214.

1. Warranty Period: 20 years.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Basis of Design: Drawings and specifications are based on products by KAWNEER CO.

B. Other Acceptable Manufacturers: ~~Equal~~ products by the following manufacturers are acceptable providing they meet or exceed the requirements specified herein and conform to the design intent indicated on the drawings:

1. CRL – U.S. ALUMINUM
2. EFCO
3. OLDCASTLE BUILDING ENVELOPE

4. TUBELITE DIVISION, INDAL, INC.
5. YKK AMERICA

2.02 MATERIALS

A. Aluminum: Alloy and temper recommended 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.

B. Steel Reinforcement: Manufacturer's standard zinc-rich, corrosion-resistant primer, complying with SSPC-PS Guide No. 12.00; applied immediately after surface preparation and pretreatment. Select surface preparation methods according to recommendations in SSPC-SP COM and prepare surfaces according to applicable SSPC standard.

1. Structural Shapes, Plates, and Bars: ASTM A 36.
2. Cold-Rolled Sheet and Strip: ASTM A 1008.
3. Hot-Rolled Sheet and Strip: ASTM A 1011.

2.03 STOREFRONT, WINDOW FRAMING AND ENTRANCE DOOR SYSTEMS

A. Type: An integrated system of extruded aluminum sections, glazing devices, sealing devices, doors and hardware and operable windows.

B. Materials: Provide aluminum alloy and temper for each shape as recommended by manufacturer and processor to comply with requirements of performance, fabrication, and application of finish.

1. Thickness: As required to meet design requirements with a minimum of 1/8" for major sections.

C. Framing: KAWNEER 451T, framing for 1" insulating glass.

1. Type: Thermally broken, outside glazed, fixed type framing as indicated on drawings.
2. Frame
   a. Members: Main frame members designated specifically for manufacture of aluminum windows extruded from 6063-T5 aluminum alloy.
   b. Glazing: Extruded snap-in type bead. Units to accept 1" insulating glass.
   c. Trim: Provide all trim, sills, flashings and closures to complete installation.
   d. Size
      1) Sightline: Nominal 2".
      2) Depth: 4-1/2”.

3. Glazing Plane: As indicated
4. Special Framing Shapes: Provide as detailed or as required to maintain design intent as indicated on building elevations drawings and section drawings. Aluminum extruded shapes and bent aluminum sheet, minimum 0.063", finished after fabrication.
5. Vestibule Framing: Non-thermally broken; dimensions to match exterior framing. KAWNEER Trifab II 451. Units to accept 1/4" glass.
6. Interior Framing: Non-thermally broken. KAWNEER Trifab II 451. Units to accept glass thickness indicated.
    a. Designed to resist a 200 lb/SF concentrated load in any direction where indicated on the drawings.
    b. Size
        1) Sightline: Nominal 2".
        2) Sill Sightline: Nominal 4-1/2”
        3) Depth: 4-1/2”.
7. Provide extruded solid backed framing shapes where framing abuts solid wall conditions.

D. Performance Requirements: Exterior window wall system (excluding doors) shall meet or exceed the following performance requirements.

1. Wind loads: Provide storefront system; include anchorage, capable of withstanding wind load design pressures indicated on the drawings.
2. Thermal Movement: Window framing system shall be designed to provide for expansion and contraction of component materials caused by a surface temperature range of 180^{o} F., without causing buckling, stresses on glass, failure of joint seals, undue stress on structural elements, damaging loads on fasteners, reduction of performance, or other detrimental effects.
    a. Doors: Function properly over the above specified temperature range.
3. Air Infiltration: Air leakage shall not exceed 0.06 cfm per square foot of fixed wall area when tested in accordance; with ASTM E283 at test pressure not less than 6.24 psf.
4. Water Infiltration
    a. Provide drainage to exterior face of framing any water entering at joints.
    b. No uncontrolled water penetration shall occur when tested in accordance with ASTM E331, at test pressure not less than 8.0 psf.
5. Structural Properties - Uniform Load: A static air design load of 20 psf shall be applied in the positive and negative direction in accordance with ASTM E 330. There shall be no deflection in excess of L/175 of the span of any framing member. At a structural test load equal to 1.5 times the specified design load, no glass breakage or permanent set in the framing members in excess of 0.2% of their clear spans shall occur.
6. Thermal Properties
    a. Thermal Transmittance (U-factor): When tested to AAMA Specification 1503, the thermal transmittance (U-factor) shall not be more than (Glass to Center) 0.44 (low-e) BTU/hr/ft sq./degree F
    b. Condensation Resistance (CRF): When tested to AAMA Specification 1503, the condensation resistance factor shall not

be less than (Glass to Center) 62 frame and 68 glass (low-e)

E. Glazed Aluminum Entrance Doors: Standard duty, wide stile, manufacturer's standard, single acting aluminum entrances. Provide thermally broken units without vestibules

1. Stiles: Nominal 4 ¼” to 5" wide.
2. Rails
   a. Top: 4 ¼” to 5" wide.
   b. Bottom: 10" high.
3. Intermediate Rail: Provide if indicated.
4. Section Wall Thickness: .125" for major components; 0.05" for glazing moldings.
5. Door Thickness: 1-3/4” in vestibules. Provide thermally broken 2 ¼” units without vestibules.
6. Corners: Stiles through design, joined by concealed bolts and weld.
7. Provide complete with snap-in glazing stops and gaskets.
8. Sizes: As indicated. Provide single or pairs of doors as scheduled.
9. Exterior Entrance Weatherstripping: Stile with dual pile weathering with polymeric fin and bulb polymeric weatherstripping and pile weathering with polymeric fin in door frame system or equal by other approved manufacturer. Locate weatherstripping at jambs, head and meeting stiles (as applicable). Provide bottom rail with EPDM blade gasket sweep. Size sweep to close against door threshold. Sweep housing finish to match door finish.
10. Glazing: 1/4" thick in vestibules, insulated units without vestibules, unless otherwise indicated.

2.04 FINISHES

A. All exposed aluminum surfaces shall receive an Architectural Class 1, clear anodized coating; AA-M12C22A41, minimum 0.018 mm thickness.

2.05 ENTRANCE DOOR HARDWARE

A. Prepare and reinforce doors and frames for hardware. Factory fit and install hardware in accordance with Section 08 71 10 and manufacturer's requirements.

2.06 ACCESSORIES

A. Fasteners: Aluminum, non-magnetic stainless steel or other materials warranted by manufacturer to be non-corrosive and compatible with aluminum components. Finish exposed fasteners to match aluminum work.

B. Flashing, Trim and Accessories: Provide as required to complete the work. Finish shall match aluminum entrances and storefront finishes. Work includes:

1. Aluminum closure panels, flashing and trim.
2. Concealed Flashing: Dead-soft stainless steel, 26 gauge minimum, type selected by manufacturer for compatibility.

3. All trim materials shall be finished after fabrication, unfinished exposed edges at holes and trim terminations are not acceptable.

C. Brackets and Reinforcements: Manufacturer's high strength aluminum units where feasible; otherwise, nonmagnetic stainless steel or hot-dip galvanized steel complying with ASTM A123.

D. Bituminous Coatings: Cold applied asphalt mastic complying with SSPC PS 12, compounded for 30 mil thickness per coat.

E. Structural Sealant: Designed to carry gravity loads of glazing and capable of withstanding tensile and shear stresses imposed by structural-sealant-glazed storefront/strip windows without failing adhesively or cohesively. When tested for preconstruction adhesion and compatibility, cohesive failure of sealant shall occur before adhesive failure.

1. Structural Glazing Sealants: ASTM C 1184, chemically curing silicone formulation that is compatible with system components with which it comes in contact, specifically formulated and tested for use as structural sealant and approved by structural-sealant manufacturer for use in storefront/strip windows assembly indicated.
   a. Color: As selected by Architect from manufacturer's full range of colors.
2. Sealants used inside the weatherproofing system shall comply with the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."

2.07 FABRICATION

A. Provide manufacturer's standard fabrication and accessories that comply with indicated requirements. Minor dimension differences will be accepted in order to utilize manufacturer's standard products.

B. Fit and assemble the work at the shop to the greatest extent possible. Disassemble only as required for shipment and erection. Maintain true continuity of line and accurate relation of planes and angles. Provide secure attachment and support at mechanical joints, with hairline fit of contacting members. Conceal fasteners wherever possible.

C. Reinforce aluminum work as necessary at points of support or anchorage and at mechanical joints and points of attachment to meet performance requirements and for support of the system. Separate dissimilar metals with bituminous paint or preformed separators that will prevent corrosion. Separate metal surfaces at moving joints with plastic inserts or other non-abrasive concealed inserts.

D. Coordinate work of this section with other work for proper sequence of construction without delays. Verify dimensions of supporting structure and other elements that precede wall system work before fabrication of required

components. Provide for erection tolerances for other work where field measurements cannot be obtained.

PART 3 EXECUTION

3.01 INSPECTION

A. Examine substrates supporting structure, and installation conditions. Do not proceed with aluminum entrances erection until unsatisfactory conditions have been corrected.

B. Installation constitutes acceptance of existing conditions and responsibility for satisfactory performance.

3.02 INSTALLATION

A. General

1. Do not install component parts that are observed to be defective, including warped, bowed, dented, abraded and broken members.
2. Remove and replace members that have been damaged during installation or thereafter before time of acceptance.
3. Do not cut or trim component parts during erection, in a manner which would damage finish, decrease strength or result in a visual imperfection or a failure in performance of the work.

B. Install components in accordance with the manufacturer's installation instructions and recommendations.

C. Install component parts level, plumb, true to line and with uniform joints and reveals. Secure to structure with non-staining and non-corrosive shims, anchors, fasteners, spacers and fillers.

D. Assembly and Anchorage: Anchor component parts securely in place, by bolting or other permanent mechanical attachment system, which will comply with performance requirements and permits movements as required.

1. Anchor storefront sill to a continuous interior aluminum anchor.

E. Apply a bituminous coating or other suitable separator on concealed contact surfaces of dissimilar materials, before assembly or installation to prevent corrosive or electrolytic action.

F. Set sill members and entrance thresholds in a bed of sealant compound, or with joint fillers or gaskets to provide weathertight requirements.

G. Install glass and glazing, in accordance with Section 08 81 00 and the manufacturer's requirements.

H. Install joint sealants specified in Section 07 92 00, in accordance with the

manufacturer's requirements.

I. Coordinate installation of storefront framing with installation of air/vapor barrier transition membrane.

J. Adjust operating hardware to function properly, without binding, and to provide tight proper fit at contact points and weatherstripping.

3.03 CLEANING AND PROTECTION

A. Protect glass from breakage immediately upon installation, by attachment of streamers to framing held away from glass. Do not apply markings of any type to surfaces of glass.

B. Remove protective coating when completion of construction activities no longer require its retention.

C. Immediately before acceptance of the work, clean the aluminum entrance systems thoroughly, inside and out. Demonstrate proper cleaning methods to Owner's maintenance personnel during final cleaning. Prepare a "Cleaning and Maintenance Manual" listing types of cleaning compounds, cleaning methods, sealants and glazing materials used for cleaning, repair and maintenance of work and turn over to Owner upon acceptance of the work.

END OF SECTION

SECTION 08 43 14

INTERIOR ALUMINUM STOREFRONT

PART 1 GENERAL

1.01 WORK INCLUDED

A. Provide aluminum storefront systems as shown and specified. Work includes:

1. Aluminum framing.
2. Glass and glazing of the systems.
3. Anchors, fasteners, flashings, trim and accessories to complete the work.
4. Sealants required within storefront construction.
5. All gaskets, sealants and tapes required in final assembly of the work.
6. Aluminum doors.

1.02 RELATED SECTIONS

A. Joint Sealants: Section 07 92 00.

B. Aluminum-Framed Entrances and Storefronts: Section 08 41 13.

C. Glass and Glazing: Section 08 81 00.

D. Door Hardware: Section 08 71 10.

E. Sustainable Design Requirements: Section 01 81 13.

F. VOC Limits: Section 01 81 16.

1.03 REFERENCES

A. Architectural Aluminum Manufacturer's Association (AAMA)

B. American Society for Testing and Materials (ASTM)

C. American Architectural Manufacturers Association (AAMA): Voluntary Specification, Performance Requirements and Test Procedures for Superior Performing High Performance Organic Coatings on Architectural Extrusions and Panels, AAMA 2605.

1.04 QUALITY ASSURANCE

A. Provide interior aluminum storefront systems manufactured by a single firm specializing in the production of this type of work.

B. Painted Finishes: Factory painted finish to be performed by an applicator

specifically approved by the paint manufacturer. The applicator shall provide written notification of approval by paint manufacturer prior to application of the finish.

1.05 SUBMITTALS

A. Submit the following in accordance with the General Conditions and Section 01 33 23:

1. Framing system details.
2. Installation instructions.
3. Finish samples.

B. Shop Drawings: Include complete evaluations of all systems including doors; details and methods of anchorage; details of construction finishes; methods of assembly; location and installation of hardware and reinforcement for same; size, shape and thickness of materials; joints and connections; details of joining with other work.

C. Product Data: Submit manufacturer's specifications for materials and fabrication of work, and instructions and recommendations for installation and maintenance. Include certified test reports showing compliance with requirements where a test method is indicated.

D. Sustainable Design Documentation Submittals: Comply with Section 01 81 13.

1. VOC Limits: Include documentation verifying product Low Emitting Material Building Product Disclosures and Optimization.

1.06 DELIVERY, STORAGE AND HANDLING

A. Pack, deliver, handle, store and protect materials from damage in accordance with AAMA Curtain Wall #10, "Care and Handling of Architectural Aluminum" recommendations.

1. Remove paper type wrappings when unloading.
2. Store materials inside the buildings in clean, dry ventilated areas free of dust or corrosive fumes.
3. Stack members vertically or on edge, shim between components to provide water drainage and ventilation. Protect with adequate coverings, placed to provide adequate air circulation.
4. During installation, protect materials from lime mortar, run-off from concrete and copper, weld splatter, acids, roofing materials, solvents and abrasive cleaner.

PART 2 PRODUCTS

2.01 MATERIALS

A. Aluminum: Alloy and temper recommended by manufacturer for type of use and finish indicated.

1. Sheet and Plate: ASTM B 209.
2. Extruded Bars, Rods, Shapes, and Tubes: ASTM B 221.
3. Extruded Structural Pipe and Tubes: ASTM B 429.

2.02 STOREFRONT SYSTEM

A. Type: An integrated system of extruded aluminum sections, glazing devices, sealing devices.

B. Framing:

1. Provide complete with snap-in glazing stops and gaskets for the thicknesses of glass units indicated or specified. Provide rectangular glazing stops; triangular or beveled not permitted.
2. Provide silicone glazed system framing members where indicated.

C. Provide door frame extrusions as required to fit in storefront framing system or as individual framed opening as scheduled.

D. Manufacturer: KAWNEER Trifab 450 CG." and “Trifab VG 450”, 1-3/4" x 4-1/2" members. ~~Equal~~ products by VISTAWALL; EFCO, YKK AMERICA, RACO INTERIORS or TUBELITE are acceptable provided they comply with requirements stated herein.

2.03 DOORS

A. Glazed Aluminum Interior Doors: Wide stile, single acting, glazed aluminum entrances.

1. Sizes: As indicated. Provide single or pairs of doors as scheduled.
2. Stiles: Nominal 5-1/2" wide.
3. Rails
   a. Top: 5" high.
   b. Bottom: 10" high.
4. Section Wall Thickness: .125" for major components; 0.05" for glazing moldings.
5. Door Thickness: 1-3/4".
6. Corners: Stiles through design, joined by concealed bolts and weld.
7. Provide complete with snap-in glazing stops and gaskets. Provide rectangular glazing stops; triangular or beveled not permitted.
8. Glazing: 1/4", unless otherwise indicated.

B. Interior Flush Doors: 1-3/4” thick with smooth aluminum faces and foam-in-place polyurethane core. Reinforce for hardware as recommended by manufacturer. No through fasteners permitted.

1. Fabrication: 5-ply construction with 0.165 inch composite skin.

a. Exterior Door Ply: .040 inch smooth 5005-H15 stretcher leveled aluminum bonded to tempered hardboard.
b. Core: ISO-25 Class 1 polyisocyanurate foam; 2 pounds per square foot density.
c. Perimeter: Nominal 4 inch x .125 inch aluminum tube.

2. Glazing Style: Snap-on, interior
3. Door Thickness: 1-3/4 inches (45 mm)
4. Manufacturers: CLINE ALUMINUM DOORS, ALUTECH CORPORATION and storefront manufacturers listed under paragraph 2.01B.

2.03 FINISHES

A. All exposed aluminum surfaces shall receive an Architectural Class 1, clear anodized coating; AA-M12C22A41, minimum 0.7 mil thickness.

2.04 ACCESSORIES

A. Fasteners: Aluminum, non-magnetic stainless steel or other materials warranted by manufacturer to be non-corrosive and compatible with aluminum components. Finish exposed fasteners to match aluminum work.

B. Brackets and Reinforcements: Manufacturer's high strength aluminum units where feasible; otherwise, nonmagnetic stainless steel or hot-dip galvanized steel complying with ASTM A123.

C. Bituminous Coatings: Cold applied asphalt mastic complying with SSPC PS 12, compounded for 30 mil thickness per coat.

D. Clear Protective Coatings: Provide aluminum surfaces covered with strippable surfacing designed specifically for protection of aluminum finish.

2.05 FABRICATION

A. Aluminum Storefronts: Provide manufacturer's standard fabrication and accessories which comply with indicated requirements. Minor dimension differences will be accepted in order to utilize manufacturer's standard products.

B. Shop fabricate aluminum storefront systems. Fit and assemble the work at the shop to the greatest extent possible. Disassemble only as required for shipment and erection. Maintain true continuity of line and accurate relation of planes and angles. Provide secure attachment and support at mechanical joints, with hairline fit of contacting members. Conceal fasteners wherever possible.

C. Reinforce aluminum work as necessary at points of support or anchorage and at mechanical joints and points of attachment to meet performance requirements and for support of the system. Separate dissimilar metals with bituminous paint or preformed separators which will prevent corrosion. Separate metal surfaces at moving joints with plastic inserts or other non-abrasive concealed inserts.

D. Coordinate aluminum storefront systems work with other work for proper

sequence of construction without delays. Verify dimensions of supporting structure and other elements which precede wall system work before fabrication of required components. Provide for erection tolerances for other work where field measurements cannot be obtained.

PART 3 EXECUTION

3.01 INSPECTION

A. Examine substrates supporting structure, and installation conditions. Do not proceed with aluminum storefront erection until unsatisfactory conditions have been corrected.

B. Installation constitutes acceptance of existing conditions and responsibility for satisfactory performance.

3.02 INSTALLATION

A. General

1. Do not install component parts which are observed to be defective, including warped, bowed, dented, abraded and broken members. Remove and replace members which have been damaged during installation or thereafter before time of acceptance.
2. Do not cut or trim component parts during erection, in a manner which would damage finish, decrease strength or result in a visual imperfection or a failure in performance of the work.

B. Install the aluminum storefront systems in accordance with the manufacturer's installation instructions and recommendations.

C. Install component parts level, plumb, true to line and with uniform joints and reveals. Secure to structure with non-staining and non-corrosive shims, anchors, fasteners, spacers and fillers.

D. Assembly and Anchorage: Anchor component parts securely in place, by bolting or other permanent mechanical attachment system, which will comply with performance requirements and permits movements as required.

E. Apply a bituminous coating or other suitable separator on concealed contact surfaces of dissimilar materials, before assembly or installation to prevent corrosive or electrolytic action.

F. Install aluminum storefront system glass and glazing, in accordance with Section 08 81 00 and the manufacturer's requirements.

G. Install joint sealants within the aluminum storefront systems work with elastomeric joint sealants specified in Section 07 92 00, in accordance with the manufacturer's requirements.

3.03 CLEANING AND PROTECTION

A. Protect glass from breakage immediately upon installation, by attachment of streamers to framing held away from glass. Do not apply markings of any type to surfaces of glass.

B. Remove protective coating when completion of construction activities no longer require its retention.

C. Immediately before acceptance of the work, clean the aluminum storefront systems thoroughly. Demonstrate proper cleaning methods to Owner's maintenance personnel during final cleaning. Prepare a "Cleaning and Maintenance Manual" listing types of cleaning compounds, cleaning methods, sealants and glazing materials used for cleaning, repair and maintenance of work and turn over to Owner upon acceptance of the work.

D. Prepare a "Cleaning and Maintenance Manual" listing types of cleaning compounds, cleaning methods, sealants and glazing materials used for cleaning, repair and maintenance of work and turn over to Owner upon acceptance of the work.

END OF SECTION

SECTION 08 81 00

GLASS AND GLAZING

PART 1 GENERAL

1.01 SCOPE

A. Work Included: Provide glass and glazing for all exterior and interior openings as indicated on the drawings and specified herein. Work also includes the following:

1. Glass for metal framed skylight systems.

B. Work Not Included: Glass and glazing not provided under this Section are as follows:

1. Framed Mirrors: Section 10 28 13.

1.02 RELATED SECTIONS

A. Sustainable Design Requirements: Section 01 81 13.

B. VOC Limits: Section 01 81 16.

1.03 PERFORMANCE REQUIREMENTS

A. General: Provide glazing systems capable of withstanding normal thermal movement and wind and impact loads (where applicable) without failure, including loss or glass breakage attributable to the following: defective manufacture, fabrication, and installation; failure of sealants or gaskets to remain watertight and airtight; deterioration of glazing materials; or other defects in construction.

B. Glass Design: Glass thicknesses indicated or specified are minimums and are for detailing purposes only. Confirm glass thickness by analyzing project loads and in-service conditions. Provide glass lites for various size openings in nominal thicknesses indicated, but not less than thicknesses and in strengths (annealed or heat treated) required to meet, as a minimum, the following criteria:

1. Glass Thicknesses: Select minimum glass thicknesses to comply with ASTM E1300, according to the following requirements:
   a. Specified Design Wind Loads: 30 psf.
   b. Probability of Breakage for Vertical Glazing: 8 lites per 1000 for lites set vertically or not more than 15 degrees off vertical under wind action.
      1) Load Duration: 60 seconds or less.
   c. Probability of Breakage for Sloped Glazing: 1 lite per 1000 lites set more than 15 degrees off vertical and under wind and snow action.
      1) Load Duration: 30 days.

d. Maximum Lateral Deflection: For the following types of glass supported on all four edges, provide thickness required that limits center deflection at design wind pressure to 1/50 times the short side length or 1", whichever is less.
   1) For monolithic glass lites, heat treated to resist wind loads.
   2) For insulating glass.
   3) For laminated glass lites.
e. Minimum Glass Thickness for Exterior Lites" ¼".

C. Thermal Movements: Provide glazing that allows for thermal movements resulting from the following maximum change (range) in ambient and surface temperatures acting on glass framing members and glazing components. Base engineering calculation on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.

1. Temperature Change (Range): 120° F, ambient; 180° F, material surfaces.

1.04 REFERENCED STANDARDS

A. Reference Standards: Wherever the following abbreviations are used herein, they shall refer to the corresponding standard.

1. AAMA: American Architectural Manufacturers Association.
2. ANSI: American National Standards Institute.
3. ASTM: American Society for Testing and Materials.
4. GANA: Glass Association of North America.
5. IGMA: Insulated Glass Manufacturers Alliance.
6. NFPA: National Fire Protection Association.
7. IGCC: Insulating Glass Certification Council.

B. Glazing Publications: Comply with published recommendations of glass product manufacturers and organizations listed below, except where more stringent requirements are indicated herein.

1. Glass Association of North America (GANA) "Glazing Manual."
2. Insulated Glass Manufacturers Alliance (IGMA)
   a. TM-3000 "Vertical Glazing Guidelines"
   b. TB-3001 "Sloped Glazing Guidelines".
3. American Architectural Manufacturers Association (AAMA)
   a. TIR-A7 "Sloped Glazing Guidelines"
   b. GDSG-1 "Glass Design for Sloped Glazing".

1.04 QUALITY ASSURANCE

A. Installer Qualifications: An experienced installer who has completed glazing similar in material, design, and extent to that indicated for this project.

B. Fire-Rated Door Assemblies: Provide assemblies complying with NFPA 80 that are listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for fire ratings indicated, based on testing according to NFPA

252.

C. Safety Glass Standards: Category II materials complying with testing requirements in 16 CFR 1201 and ANSI Z97.1.

1. Each lite shall bear permanent, non-removable label manufacturers designation of safety glazing standard for which it complies.

D. Insulating Glass Certification Program: Provide insulating glass units permanently marked either on spacers or on at least one component lite of unit with appropriate certification label of Insulating Glass Certification Council (IGCC).

E. Allowable Tolerances: Thicknesses of glass specified are nominal; provide glass manufactured to tolerances listed in GANA Manual.

F. Fire- Rated Glass: Each lite shall bear permanent, non-removable label of UL certifying it for use in tested and rated fire protective assemblies.

1.05 SUBMITTALS

A. Submit manufacturer's product data and installation instructions for each type of glass, glazing sealants and accessories required.

1. Indicate structural, physical and environmental characteristics, size limitations, special handling requirements, etc.

B. Submit insulating glass manufacturer's certification indicating units meet or exceed specified requirements.

C. Submit laminated glass manufacturer's certification indicating units meet or exceed specified requirements.

D. Shop Drawings: Required data for shop drawings on glazing may be incorporated with shop drawings for framing members. Show thicknesses of glass; proposed "bites" in frames, sizes and locations of blocks, clips, beads, stops edge treatments; note quality, type and strength of each lite.

E. Samples: Submit and obtain approval of samples before proceeding with glass fabrication. Minimum two 12" x 12" samples of each glass type required, except clear monolithic glass. Submit color samples of exposed sealants and/or gaskets.

F. Sustainable Design Documentation Submittals: Comply with Section 01 81 13.

1. VOC Limits: Include documentation verifying product Low Emitting Material Building Product Disclosures and Optimization.

1.06 DELIVERY, STORAGE AND HANDLING

A. Deliver, store and handle glazing materials in accordance with manufacturer's recommendations to prevent damage and deterioration.

B. Various items to receive glazing as specified elsewhere may be factory-glazed or site-glazed at Contractor's option.

C. Deliver glazing compounds and sealants in manufacturer's unopened labeled containers.

D. Deliver glass with manufacturer's labels intact. Do not remove labels until glass has been installed.

1.07 PROJECT CONDITIONS

A. Field verify measurements and conditions of installations.

B. Examine all details. Provide proper fitting for details indicated.

C. Do not perform work under adverse weather or job site conditions. Install liquid sealants when temperatures are within lower or middle third of temperature range recommendations by manufacturer.

D. Protect work from damage during and after installation until project acceptance.

1.08 WARRANTY

A. Contractor to guarantee work under this Section against defects of materials, fabrication and installation. Guarantee period is one year, except where specified otherwise. Defects include, but are not necessarily limited to:

1. Weather tightness: Two (2) year warranty.

B. Insulating Glass: Submit manufacturer's written warranty that for ten (10) years from date of substantial completion, a replacement will be provided (furnished and installed) for any unit which develops edge separation, thermal stress cracks, or other defects which materially obstruct vision through the glass or affect thermal and physical integrity of insulating glass units, except warranty shall not cover glass breakage from other than natural causes. Defective units shall be replaced at no additional cost to the Owner.

C. Coated Glass: Submit manufacturer's written warranty that for five (5) years from date of substantial completion, a replacement will be provided for defective units. Defects are defined as peeling, cracking or deterioration in coating due to normal conditions and not due to handling or installation contrary to glass manufacturer's published instructions. Defective units shall be replaced at no additional cost to the Owner.

D. Laminated Glass: Submit manufacturer's written warranty that for five (5) years from date of substantial completion a replacement will be provided for laminated glass having manufacturing defects which result in edge separation or other defects which materially obstruct vision through the glass. Defective units shall be replaced at no additional cost to the Owner.

PART 2 PRODUCTS

2.01 MANUFACTURER

A. Acceptable Manufacturers and Fabricators: Specifications herein are based on glass and materials manufactured or fabricated by the following companies. Not all firms listed manufacture or fabricate all the items specified herein. However, to ensure consistent quality of appearance and performance, provide each type or kind of glass or material from a single source. Manufacturers for specialty products are listed within the specification to establish a particular type, color, pattern, etc. ~~Equal~~ products by the manufacturers listed are acceptable providing they meet the type, color, pattern, etc. as approved by the Architect.

1. Manufacturers
   a. AGC FLOAT GLASS NORTH AMERICA
   b. VITRO
   c. GUARDIAN INDUSTRIES
   d. SAINT GOBAIN
2. Fabricators
   a. VIRACON
   b. OLDCASTLE BUILDINGENVELOPE
   c. ARCH ALUMINUM & GLASS LLC
   d. TRULITE GLASS AND ALUMINUM

2.02 PRIMARY FLOAT GLASS

A. Conformance: Type I, Class 1 for clear glass, Quality q^3, conforming to ASTM C1036.

B. Thickness: 1/4", unless otherwise indicated.

C. Color: Clear.

1. When used in insulating units, provide color specified under each insulating unit.

2.03 HEAT TREATED FLOAT GLASS

A. Conformance: Condition A, Kind FT Type I, Class 1 for clear glass, conforming to ASTM C1048.

1. Fabrication Process: By horizontal (roller-hearth) process with roll-wave distortion parallel to bottom edge of glass as installed unless otherwise indicated.
2. Roll Wave Maximum Distortion Tolerance: 0.003 inch target with 0.005 inch maximum peak to valley measurement.
3. Bow and Warp Maximum Tolerance: 50 percent of the maximum allowed in ASTM C 1048.

B. Thickness: 1/4", unless otherwise indicated.

C. Color: Clear.

1. When used in insulating units, provide color specified under each insulating unit.

D. Locations: Safety glazing locations as designated and required by applicable code(s) and where indicated.

2.04 COATED FLOAT GLASS

A. General: Provide coated glass complying with this article and in schedules at the end of Part 3.

B. Low E, Sputter Coated Float Glass: Float glass with metallic-oxide or metallic nitride coating deposited by vacuum deposition process after manufacture and heat treatment (if any), complying with requirements specified in schedules at end of Part 3.

2.05 WIRE GLASS

A. Wire Glass: USE PROHIBITED.

2.06 LAMINATED GLASS

A. Conformance: Kind LHS conforming to ASTM C1172 "Laminated Architectural Flat Glass" and ANSI Z97.1.

B. Thickness

1. Skylight: Each pane 1/4" inch.

C. Interlayer: As indicated below; clear or in colors/patterns indicated; with a proven record of no tendency to bubble, discolor, or lose physical and mechanical properties after laminating glass lites and installation. Provide interlayer type as recommended by manufacturer for application intended (safety, decorative, security, structural or acoustical).

1. Manufacturer: KURARAY Trosifol ~~or approved equal~~.

D. Laminating Process: Fabricate to produce glass free of foreign substances and air or glass pockets as follows:

1. Laminate lites with polyvinyl butyral interlayer in autoclave with heat plus pressure.

2.07 INSULATING GLASS

A. Sealed Insulating Glass: General: Provide preassembled units consisting of

organically sealed panes of glass enclosing a hermetically sealed dehydrated air space and complying with ASTM E2190 for performance classification indicated as well as with other requirements specified for glass characteristics, air space, sealing system, sealant, spacer material, corner design and desiccant.

1. For properties of individual glass making up units, refer to requirements specified in schedule at the end of Part 3 as applicable to types, kinds, classes and conditions.
2. Provide Kind HS (heat-strengthened) float glass in place of annealed glass where needed to resist thermal stresses induced by differential shading of individual glass lites to comply with glass design requirements. Provide Kind FT (fully tempered) where safety glass is indicated or required.

B. Warm Edge Spacer Construction: Combination of stainless steel and polypropylene. Double sealed with a primary seal of polyisobutylene and a secondary seal of silicone. Delete low-E coating prior to fabrication of insulating units according to coated glass manufacturer's instructions.

1. Spacer to be black; clear aluminum color not permitted.

2.08 MISCELLANEOUS GLASS TYPES

A. Fire-Rated Glass

1. 20 Minute - For use in 20 minute rated doors only. Superlite I manufactured by SAFTI FIRST, PyroEdge-20 by AGC GLASS COMPANY, SGG Pyroswiss US by VETROTECH SAINT GOBAIN or Fireglass 20 by TECHNICAL GLASS PRODUCTS. ¼" thick tempered glass with a 20 minute fire-rating.
2. 45 Minute - For use in 45 minute door and window applications. Superlite II-XL manufactured by SAFTI FIRST, Pyrobel by AGC GLASS COMPANY, SGG Swissflam-45 by VETROTECH SAINT GOBAIN or Pyrostop by PILKINGTON. ¾" thick unit comprised of inboard and outboard tempered lites protecting a fire resistive interlayer.
3. All fire-rated glazing to have Logo: Each piece of fire-rated glazing shall be labeled with a permanent logo including name of product, name of manufacturer, testing laboratory, fire rating period, and safety glazing standards.

2.09 GLAZING MATERIALS AND ACCESSORIES

A. Glazing Sealants and Compounds: General: Provide materials that comply with Project Sustainable Design Requirements and Low Emitting Material goals.

1. Comply with manufacturer's recommendations for selection of hardness. Select materials and variations or modifications for compatibility with surfaces contacted in the installation.
2. Exterior Glazing: Compatible with one another and with other materials they contact, including glass products, seals of insulating-glass units, and glazing channel substrates, under conditions of service and application, as demonstrated by sealant manufacturer based on testing and field

experience. Comply with sealant and glass manufacturers' written instructions for selecting glazing sealants suitable for applications indicated and for conditions existing at time of installation.

a. Glazing Sealant: One-part neutral-curing silicone glazing sealant, ASTM C 920 Class A, Type S, Grade NS, Class 100/50, Use NT; for high movement joints at metal-to metal and glass to metal.
   1) Dow Corning Corporation; 790
   2) GE Advanced Materials - Silicones; SilPruf LM SCS2700
   3) Pecora Corporation; 890
   4) Tremco Incorporated; Spectrem 1

b. Glazing Sealant: One-part neutral-curing silicone glazing sealant, ASTM C 920, Type S, Grade NS, Class 50, Use NT; for general applications in glazing installation subject to high movement including perimeter; use non-staining formula at absorbent perimeter applications
   1) DOW CORNING CORPORATION; 795 or 756 SMS
   2) GE ADVANCED MATERIALS -SILICONES; SilPruf NB SCS9000 or SilPruf SCS2000
   3) PECORA CORPORATION; 864
   4) TREMCO INCORPORATED; Spectrem 2

c. Glazing Sealant: One-part neutral-curing silicone glazing sealant complying with ASTM C 920, Type S, Grade NS, Class 25, Use NT; for general applications in glazing installation including perimeter; use non-staining formula at absorbent perimeter applications.
   1) DOW CORNING CORPORATION; 791
   2) GE ADVANCEDMATERIALS-SILICONES; UltraGlaze SSG4000 or UltraGlaze SSG4000AC
   3) TREMCO INCORPORATED; Proglaze SSG or Tremsil 600

d. Structural Glazing Sealant: ASTM C1184, chemically curing silicone formulation that is compatible with system components with which it comes in contact, specifically formulated and tested for use as structural sealant and approved by structural-sealant manufacturer for use in glazing assembly indicated.
   1) DOW CORNING CORPORATION; 995.
   2) GE ADVANCED MATERIALS -SILICONES; UltraGlaze SSG4000.
   3) PECORA CORPORATION; 896.
   4) TREMCO INCORPORATED; Proglaze SG.

3. Interior Glazing: Compound of polymerized butyl rubber and inert fillers, with or without polyisobutylene modification, solvent based, 95% solids, formed and coiled on release paper, tack-free in 24 hours, paintable, non-staining.

B. Miscellaneous Glazing Materials

1. Cleaners, Primers and Sealers: Type recommended by sealant or gasket manufacturer.
2. Setting Blocks: Neoprene or EPDM, 80-90 durometer hardness, with proven compatibility with sealants used.

3. Spacers: EPDM, 40-50 durometer hardness with proven compatibility with sealants used.
4. Compressible Filler (Rod): Closed cell or waterproof jacketed rod stock of synthetic rubber or plastic form, compatible space with sealants used, flexible and resilient, with 5-10 psi compression strength for 25% deflection.

2.13 FABRICATION

A. General: Fabricate glass and other glazing products in sizes required to glaze openings indicated, with edge and face clearances, edge and surface conditions, and bite complying with recommendations of product manufacturer and referenced glazing standard as required to comply with system performance requirements.

1. Glass Thickness: Design analyze and comply with published recommendations of glass product manufacturers and organizations listed herein.

B. Glass Cutting: Cut glass to accurate sizes and shapes as indicated on drawings. Allow edge clearances and tolerances in accordance with GANA recommendations.

1. Edges: Provide factory-cutting and factory-formed edges for all butt-glazed, heat tempered and insulating glass. Provide ground edges for all drilled holes, notches and other fabrication or finishing techniques.
2. Butt-Glazed Systems: All work in accordance with manufacturer's recommendations.
   a. Edges Exposed to Air: Polished finish.
   b. Edges Receiving Sealant: "Suede" finish.
   c. Concealed Edges: Factory option.

C. Heat Strengthened and Tempered Glass

1. Heat Strengthened: Heat treated to strengthen glass in bending to not less than 2.0 times annealed strength for the strengthened glass.
2. Tempered: Heat treated to strengthen glass in bending to not less than 4 to 5 times annealed glass strength for the strengthened glass.
3. Cut glass to required size before tempering. Comply with Glass Tempering Association recommendations.
4. Provide tongless tempered glass. When size limitations require tong edges, support each piece during tempering process so that tong marks will be concealed in the glazed system.

PART 3 EXECUTION

3.01 INSPECTION

A. Examine substrates, substructure and installation conditions. Do not proceed with glazing work until unsatisfactory conditions have been corrected.

B. Installation constitutes acceptance of existing conditions and responsibility for satisfactory performance.

3.02 PROTECTION AND PREPARATION

A. Protect glass from edge damage during handling and installation. Remove and legally dispose damaged glass off of the project site. Damaged glass is defined as glass with edge damage or other imperfections that, when installed, could weaken glass and impair performance and/or appearance.

B. Do not cut, seam, nip or abrade tempered glass.

C. Inspect each piece of glass immediately before installation and eliminate any which have observable edge damage or face imperfections.

D. Unify appearance of each series of lights by setting each piece to match other pieces, as nearly as possible. Inspect each piece and set with pattern, draw, and bow oriented in same direction as other pieces.

E. Clean glazing channels and other framing members to receive glass immediately before glazing. Remove loose coatings. Apply primer to joint surfaces receiving sealants when recommended by sealant manufacturer.

3.03 INSTALLATION - GENERAL

A. Comply with combined recommendations and technical reports of manufacturer's of glass and glazing materials used with GANA "Glazing Manual", except when more stringent requirements are indicated.

B. Install insulating units to comply with recommendations by IGMA, except as otherwise specifically indicated or recommended by glass and sealant manufacturers.

C. Glazing channel dimensions shown are intended to provide for necessary bite on glass, minimum edge clearance and adequate sealant thickness, with reasonable tolerance. Adjust as required by job conditions at time of installation.

D. Install setting blocks in sill rabbets, properly sized and located to comply with referenced glazing publications, unless otherwise required by glass manufacturer. Set blocks in thin course of compatible sealant suitable for heel bead.

E. Install primers, sealants, tapes, and gaskets in accordance with manufacturer's recommendations. Set glass without springing and install securely to prevent rattling or breakage.

F. Where wedge-shaped gaskets are driven into one side of the channel to pressurize the sealant or gasket on the opposite side, provide adequate anchorage to ensure gasket will not "walk" out when subjected to dynamic movement. Anchor gasket to stop with matching ribs, or by proved adhesives, including embedment of gasket tail in cured heal bead.

1. Miter cut and bond gasket ends together at corners where gaskets will not pull away from corners and result in voids or leaks in the glazing system.

G. Glazing Sealants for Fire-Rated Glazing Products: Products that are approved by testing agencies that listed and labeled fire-resistant glazing products with which they are used for applications and fire-protection ratings indicated.

H. Coordinate aluminum framing systems work with other work for proper sequence of construction. Verify dimensions of supporting structure and other elements which precede wall system work before fabrication of required components. Provide for erection tolerances for other work where field measurements cannot be obtained.

3.04 TAPE GLAZING

A. Position tapes on fixed stops so that, when compressed by glass, their exposed edges are flush with or protrude slightly above sightline of stops.

B. Install tapes edge-to-edge, but not necessarily in one continuous length. Do not stretch tapes to make them fit openings.

C. Where framing joints are vertical, cover these joints by applying tapes to heads and sills first and then to jambs. Where framing joints are horizontal, cover these joints by applying tapes to jambs and then to heads and sills.

D. Place joints in tapes at corners of opening with adjoining lengths butted together, not lapped. Seal joints in tapes with compatible sealant approved by tape manufacturer.

E. Do not remove release paper from tape until just before each glazing unit is installed.

F. Center glass lites in openings on setting blocks and press firmly against tape by inserting dense compression gaskets formed and installed to lock in place against faces of removable stops. Start gasket applications at corners and work toward centers of openings.

3.05 GASKET GLAZING (DRY)

A. Fabricate compression gaskets in lengths recommended by gasket manufacturer to fit openings exactly, with stretch allowance during installation.

B. Insert soft compression gasket between glass and frame or fixed stop so it is securely in place with joints miter cut and bonded together at corners.

C. Center glass lites in openings on setting blocks and press firmly against soft compression gaskets by inserting dense compression gaskets formed and installed to lock in place against faces of removable stops. Start gasket applications at corners and work toward centers of openings. Compress gaskets

to produce a weathertight seal without developing bending stresses in glass. Seal gasket joints with sealant recommended by gasket manufacturer.

D. Install gaskets so they protrude past face of glazing stops.

3.06 SEALANT GLAZING (WET)

A. Install continuous spacers, or spacers combined with cylindrical sealant backing, between glass lites and glazing stops to maintain glass face clearances and to prevent sealant from extruding into glass channel and blocking weep systems until sealants cure. Secure spacers or spacers and backings in place and in position to control depth of installed sealant relative to edge clearance for optimum sealant performance.

B. Force sealants into glazing channels to eliminate voids and to ensure complete wetting or bond of sealant to glass and channel surfaces.

C. Tool exposed surfaces of sealant to provide a substantial wash away from glass.

3.07 PROTECTION AND CLEANING

A. Protect glass from breakage immediately upon installation by attachment of streamers to framing held away from glass. Do not apply markers of any type to surfaces of glass. Remove non-permanent labels and clean surfaces.

B. Maintain glass in a reasonable clean condition during construction so that it will not be damaged by corrosive action, and will not contribute (by wash off) to the deterioration of glazing materials and other work. Remove and replace glass which is broken, chipped, cracked, abraded, or damaged in other ways during construction period, including natural causes, accidents and vandalism.

C. Wash and polish on both faces not more than four days before acceptance of the work. Comply with glass manufacturer's recommendations for final cleaning.

3.08 GLAZING SCHEDULE

A. Basis of Design Products: Glass types and products below are based on listed manufacturer.

1. Other Acceptable Manufacturers: ~~Equal~~ products by other manufacturers listed in Part 2 herein are acceptable providing they meet or exceed the performance requirements specified herein and conform to the design intent as determined by the Architect:

B. Insulating Glass – IG-1 and IG-1A

1. 1”Overall Thickness Insulating Coated Glass
   a. Exterior Glass Ply: ¼” Clear HS or FT
   b. Coating: VRE-59 Coating on #2 Surface
   c. Airspace: ½” airspace , black painted
   d. Silicone: black

e. Interior Glass Ply: ¼" Clear HS or FT

2. Performance Requirements
   a. Visible Light Transmittance: 53%
   b. Solar Energy Transmittance: 28%
   c. U-V Transmittance: 17%
   d. Visible Light Reflectance Exterior: 30%
   e. Visible Light Reflectance Interior: 19%
   f. Solar Energy reflectance: 38%
   g. Winter Nighttime U-Value: .30
   h. Summer Daytime U-Value: .27
   i. Shading Coefficient: .39
   j. Solar Heat Gain Coefficient: .34

END OF SECTION

SECTION 09 21 16

GYPSUM BOARD SYSTEMS

PART 1 GENERAL

1.01 SCOPE

A. Provide gypsum board systems consisting of wall board and framing as indicated and specified. Work includes:

1. Gypsum board and light gage framing wall systems.
2. Exterior gypsum board sheathing.
3. Suspended gypsum board ceilings and soffits including suspension framing system.
4. Fire-rated gypsum board construction where indicated.
5. Edge trim, corner beads, control joints, accent reveals, fasteners, joint treatment materials and other accessories required for a complete installation.
6. Includes installation of acoustical insulation specified in Section 07 21 00.]
7. Installation of metal access doors, including those provided by Plumbing and HVAC Contractors. See Section 08 31 13 and Divisions 22 and 23.

1.02 RELATED SECTIONS

A. Tile Backer Board: Section 09 30 00.

B. Cold-Formed Metal Framing: Section 05 40 00.

C. Acoustical Insulation: Section 07 21 00.

D. Sealant: Section 07 92 00.

E. Firestopping: Section 07 84 00.

F. Wood Blocking: Section 06 10 50.

G. Sustainable Design Requirements: Section 01 81 13.

H. VOC Limits: Section 01 81 16.

1.03 QUALITY ASSURANCE

A. Gypsum Board Systems: Comply with ASTM C840 "Application and Finishing of Gypsum Board", and as specified.

B. Metal Framing System: Comply with ASTM C754 "Installation of Steel Framing Members to Receive Screw Attached Gypsum", and as specified.

C. Reference Standards: Wherever the following abbreviations are used herein they shall refer to the corresponding standard:

1. ASTM: American Society for Testing and Materials.
2. GA: Gypsum Association.

D. Fire-Rated Construction: Comply with fire resistance ratings indicated on drawings and as required by governing authorities and codes. Provide materials, accessories and application procedures that have been listed by Underwriters Laboratories or tested in accordance with ASTM E119 for the type of construction shown.

1. Electrical Boxes: Comply with IBC Section 712.3.2 for outlet box separation.

E. STC-Rated Assemblies: For STC-rated assemblies, provide materials and construction identical to those tested in assembly indicated, according to ASTM E90 and classified according to ASTM E413 by an independent testing agency.

F. Guarantee: Submit written guarantee stating that cracks, delaminations or other imperfections in the drywall work which may develop within a period of 2 years from date of acceptance will be repaired at no cost to the Owner.

F. Job Mock-Up:

1. Prior to start of gypsum board systems, a project mock-up is to be prepared. A designated room is to receive, light gage framing, fire rated construction, acoustical treatments and related materials including resilient furring, wall board joint and screw taping and spackling, sanding and surface preparation. Job mock-up must demonstrate compliance with fire rating and acoustical assemblies required and be acceptable to Architect before beginning gypsum board finishing operations. Retain and maintain mock-up throughout remainder of project as a minimum workmanship standard. Gypsum board finishing quality must meet or exceed the quality of job mock-up.

H. Pre-Installation Conference: Conduct a pre-installation conference at Project site to review manufacturer's recommendations and referenced requirements for locating control joints in gypsum board walls and ceilings a minimum of one (1) week prior to beginning this portion of the Work. Have manufacturer's representative, contractor's representative and Architect present at this meeting.

1.04 SUBMITTALS

A. Submit manufacturer's product data and installation instructions for each gypsum board system component.

B. Submit manufacturer's certification that fire-rated assemblies proposed meet project requirements, including evidence of approved test reports acceptable to

governing building code enforcing authorities, that assemblies when installed with proposed materials, will meet or exceed fire ratings required.

C. Code-Compliance Certification of Studs and Tracks: Provide documentation that framing members are certified according to the product-certification program of the Steel Framing Industry Association (SFIA) or be a part of a similar organization that provides verifiable code compliance program.

D. Sustainable Design Documentation Submittals: Comply with Section 01 81 13.

1. VOC Limits: Include documentation verifying product Low Emitting Material Building Product Disclosures and Optimization.

1.05 DELIVERY, STORAGE AND HANDLING

A. Deliver materials in manufacturer's original, unopened labeled containers.

B. Store, protect and handle materials in accordance with manufacturer's recommendations to prevent damage, soiling and deterioration. Protect cold-formed metal framing from corrosion, deformation and other damage during delivery, storage and handing per requirements of AISI's "Code of Standard Practice".

C. Protect adjoining surfaces against damage and soiling.

1.06 JOB CONDITIONS

A. Coordinate installation sequencing with work of other trades.

1. Verify completion of other work, including that of other trades, which will be concealed by gypsum drywall construction before installation of wallboard.

1.07 FIELD CONDITIONS

A. Environmental Limitations: Comply with ASTM C840 requirements or gypsum board manufacturer's written recommendations, whichever are more stringent.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Gypsum Board: U.S. GYPSUM CO.; CERTAINTEED CORP.; GEORGIA-PACIFIC CORP.; NATIONAL GYPSUM COMPANY; CONTINENTAL BUILDING PRODUCTS.

B. Studs, Framing and Furring: CLARK DIETRICH BUILDING SYSTEMS; MARINO/WARE; STATE BUILDING PRODUCTS.

C. Others as listed for specific products.

. Products General: Provide materials that comply with Project Sustainable Design Requirements and Low Emitting Material goals.

2.02 STEEL STUDS

A. Type: Screw type "C" shape, roll formed sheet steel members conforming to requirements of ASTM C645.

1. Material: ASTM A653 steel with minimum yield strength of 33 ksi.
2. Finish: Hot-dip galvanized coating, complying with ASTM A653 G40. Finish: Hot-dip galvanized coating, complying with ASTM A653 G40 (Z120), Coating with equivalent corrosion resistance of ASTM A 653/A 653M, G40 (Z120) coating; roll-formed from steel meeting mechanical and chemical requirements of ASTM A 1003 with a zinc-based coating. Galvannealed products are not acceptable.
   a. Coatings shall demonstrate equivalent corrosion resistance with an evaluation report acceptable to the authorities having jurisdiction.
3. Gage and Width – 3-5/8” to 6” Studs
   a. 25 gage x 3-5/8": Up to and including 14'-6" high.
   b. 20 gage x 3-5/8"
      1) Over 14'-6" up to and including 16'-5" high
      2) At wall mounted cabinet locations
      3) At walls receiving ceramic tile
   c. 20 gage x 4": Over 16'-5" up to and including 17'-6" high
   d. 20 gage x 6": Over 17'-6" up to and including 24'-0".
   e. 16 gage at door jambs, heavy equipment locations, and interior partitions receiving masonry veneer.
   f. Provide other gages or widths as indicated on drawings.
4. Gage and Width – 1-5/8” to 2-1/2” Studs
   a. 25 gage x 1-5/8”: Maximum height 8’-4”
   b. 20 gage x 1-5/8”: Maximum height 9’-8”
   c. 25 gage x 2-1/2”: Maximum height 11’-3”
   a. 20 gage x 2-1/2”: Maximum height 12’-10”
5. Flange Width: Nominal 1-1/4".

B. Runners and Tracks: Designed and sized to receive studs. Thickness to match studs except deflection tracks. All thicknesses are minimum bare metal.

1. Deflection Track: Steel sheet top runner manufactured to prevent cracking of finishes applied to interior partition framing resulting from deflection of structure above; 0.0296” thickness and in width to accommodate depth of studs. Provide one of the following:
   a. #53 FlexTrack, 0.0359” typical, by SUPERIOR METAL TRIM PRODUCTS
   b. 0.0296” top track with 2” minimum legs and 0.0329” Spazzer 9200 Stud Spacer Bar by CLARK DIETRICH BUILDING SYSTEMS
   c. Slip Track (Slp Trk) by BRADY CONSTRUCTION INOVATIONS
   d. The System by METAL-LITE
   e. The Three Legged Dog by FLEX-ABILITY CONCEPTS.

f. A double slip track, 0.0296”, can be used in lieu of the proprietary deflection tracks specified above. Legs of tracks shall be minimum 2".

2. Firestop Tracks: Top runner manufactured to allow partition heads to expand and contract with movement of the structure while maintaining continuity of fire-resistance-rated assembly indicated; 0.0359” thickness and in width to accommodate depth of studs. Use only firestop top track seal product that has been UL 2079 tested for specific fire-rated construction conditions conforming to construction assembly type, space requirements and fire-rating required for each application. Provide one of the following:
   a. Fire Trak System by FIRE TRAK CORPORATION.
   b. BlazeFrame DSL or MaxTrak by CLARKDIETRICH BUILDING SYSTEMS
   c. The system by METAL-LITE INC.
   d. CFS-TTS “Firestop Top Track Seal” by HILTI, INC.

C. “EQ” (Equivalent Gauge Thickness) Steel Studs and Runners: Members that can show certified third party testing with gypsum board in accordance with ICC ES AC86 (Approved August 2015) need not meet the minimum thickness limitation or minimum section properties set forth in ASTM C 645. The submission of an evaluation report is acceptable to show conformance to this requirement.

D. Backing Plates (Blocking): Steel sheet for blocking; width to fit framing spacing; height to be 6” unless otherwise indicated.

1. Base Metal Thickness: Minimum 0.0296”.

2.03 CEILING/SOFFIT SUSPENSION SYSTEM

A. Provide the following materials unless otherwise indicated on the drawings. Metals used in exterior or areas subjected to moisture to be hot-dipped galvanized in accordance with ASTM A653 G40.

1. Main Runners: Cold-rolled steel channels; not less than 0.0538”; G90 galvanized finish for exterior and moist areas, black asphaltum painted for other areas. Spacing as required, but not to exceed 48" o.c.
   a. 1-1/2" deep where structural support framing is at 48" o.c. or less.
   b. 2" deep where structural support framing is over 48" and less than 66" o.c.
2. Cross Furring
   a. Cold-rolled steel channels, not less than 0.0538”; 3/4" size; same finish as main runners.
   b. Hat shape, 7/8" deep, 0.0179”. ASTM C645 and ASTM A653 G40 hot-dipped galvanized.
   c. 2-1/2" x 0.0296”, G40 galvanized steel studs. Provide for multiple layer applications. Provide 12" long nested studs at suspension points.
3. Wire: Stainless steel 304 alloy for exterior conditions; galvanized soft

annealed steel wire for interior conditions. Galvanized coating to meet or exceed ASTM A 641.
a. Tie Wire: Minimum 16-gage.
b. Hanger Wire: Minimum 8-gage.

B. Optional Framing: At contractor's option, proprietary furring system may be used in lieu of black iron system for dry interior conditions.

1. Description: Direct hung system consisting of interlocking main beams and cross-furring members and hanger wires, designed and manufactured specifically for suspending gypsum board ceiling.
a. ASTM C645.
b. Electrogalvanized, cold-rolled steel, 0.020" thick.
c. Double web members; 1-1/2" high with 1-3/8" capped face.
2. Manufacturer: 640 System by CHICAGO METALLIC CORP.; Drywall Suspension System by USG, WORTHINGTON STEEL COMPANY, Watercheck CONTINENTAL BUILDING PRODUCTS, Furring Systems/Drywall by ARMSTRONG.
3. Reference: ASTM C635, heavy duty.

2.04 METAL FURRING

A. Material

1. Steel Sheet Components: Comply with ASTM C645 requirements for metal, unless otherwise indicated.
2. Protective Coating: Coating with equivalent corrosion resistance of ASTM A653, G40, hot-dip galvanized, unless otherwise indicated.

B. Rigid Furring Channels: Hat-shaped; minimum 0.022 inch uncoated metal thickness; 7/8” deep, unless otherwise indicated.

C. Resilient Furring Channels: Minimum 0.0188” uncoated metal thickness; ½” deep; asymmetrical or hat-shaped members designed to reduce sound transmission.

D. Z-Shaped Furring: With slotted or nonslotted web, face flange of 1-1/4 inches, wall attachment flange of 7/8” deep, minimum uncoated metal thickness of 0.018”, and depth required to fit insulation thickness indicated.

2.05 INTERIOR GYPSUM BOARD

A. General: Comply with ASTM C1396.

B. Fire Rated Gypsum Wallboard: Type “C” or "X" (special fire retardant) to meet fire ratings for construction shown. Tapered edges. Thickness 5/8" unless otherwise indicated. Use at all locations indicated as meeting a specific fire resistance rating.

1. Provide 5/8”, Type X board at all locations not indicated to receive a

specific type board.

C. Moisture and Mold Resistant Gypsum Wallboard

1. ASTM C1396 (Section 5), Type X.
2. Edges: Tapered.
3. Thickness: 5/8 inch, unless otherwise indicated.
4. Acceptable products: Mold Tough and Mold Tough Firecode (Type X) by USG; XP and XP Fire-Shield by NATIONAL; ToughRock and ToughRock Type X by GEORGIA-PACIFIC; Mold Defense and Mold Defense Type X by CONTINENTAL BUILDING PRODUCTS or ~~equal~~ by other gypsum board manufacturers listed in 2.01A.
5. Water Absorption: ASTM C473, the average water absorption for panels is not greater than 5 percent by weight after two-hour immersion.
6. Resistance to Mold Growth: ASTM D3273, “Standard Test Method for Resistance to Growth of Mold on the Surface of Interior Coatings in an Environmental Chamber,” the panel score was 10.
7. Use on non-ceramic tiled walls, ceilings and soffits in toilet rooms, shower rooms and drying rooms; on ceramic tiled non-wet walls in toilet rooms; walls and partitions above ceilings. Maintain ratings where wall is required to be rated.

D. Impact Resistant Gypsum Wallboard: ASTM C1396 and ASTM C1629, manufactured to produce greater resistance to surface indentation and through-penetration than standard gypsum panels. Long edges tapered. Provide where indicated.

1. Classification (ASTM C1629): Level 3 (Heavy Duty).
2. Minimum Physical Properties:
   a. Thickness: 5/8 inch.
   b. Type X.
   c. Mold Resistance: minimum score of 10 per ASTM D3273
   d. Soft Body Impact: Level 3.
3. Manufacturers: SheetRock Glass Mat Mold Tough VHI by USG, Hi-Impact XP by NATIONAL GYPSUM COMPANY, Dens-Armor Impact by GEORGIA PACIFIC, Protecta HIR 300 by CONTINENTAL BUILDING PRODUCTS or ~~equal~~ by other gypsum board manufacturers listed in 2.01A.

E. Tile Backer Board: See Section 09 30 00

2.06 EXTERIOR GYPSUM BOARD AND SHEATHING

A. Exterior Sheathing and Ceiling Board: Use for exterior sheathing and where indicated on drawings. Provide in conformance with ASTM C1177, water repellent treated core and fiberglass face sheets.

1. Thickness: 5/8" thickness unless otherwise indicated.
2. Fire Rating: Type “C” or "X" (special fire retardant) to meet fire ratings for construction shown..
3. Acceptable Products: Dens-Glas by GEORGIA-PACIFIC, GlasRoc by

CERTAINTEED, Weather Defense by CONTINENTAL BUILDING PRODUCTS, EXP Sheathing by NATIONAL, or Secure Rock by USG.

4. Roof Parapets and Similar Roof Conditions:
   a. Where used as roofing substrate, provide high density, water repellent treated core with fiberglass mat and specifically designed for roofing membrane adhesion. Dens-Deck Prime Roof Board by GEORGIA-PACIFIC, USG Gypsum Fiber or ~~equal~~ by other gypsum board manufacturers listed in 2.01A. Coordinate with roofing assembly.

2.07 ACCESSORIES

A. Fasteners: Drywall screws and metal framing screws per manufacturer's instructions and recommendations for type and size, based on construction and conditions involved.

1. Steel Drill Screws: ASTM C1002.
2. Use screws complying with ASTM C 954 for fastening panels to steel members from 0.033 to 0.112 inch thick specified in Section 05 40 00.

B. Trim: ASTM C1047.

1. Manufacturers
   a. Metal: BEADEX MANUFACTURING; CLARK DIETRICH BUILDING SYSTEMS; listed gypsum board manufacturers
   b. Vinyl: VINYL TECH; VINYL CORP.; TRIM TEX
2. Corner Beads - Outside, Square Corners: 1-1/4 inch x 1-1/4 inch heavy gauge galvanized steel or vinyl, perforated.
3. Corner Beads - Outside, Non-square Corners: BEADEX B-1 Splay Flexible Corner ~~or equal~~. Concealed metal; two galvanized continuous strips laminated with paper trim; for application without mechanical fasteners.
4. Curved Edge Cornerbead: Notched or flexible edge.
5. Exposed Edges (Casing Beads): L-bead or LC-bead; exposed long flange receives joint compound. Size to suit wallboard. J-shaped bead that does not receive joint compound is not permitted.
6. Expansion (Control) Joints: Tape protected 1/4" wide x nominal 7/16" deep control slot.

C. Interior Joint Treatment Materials: ASTM C475.

1. Joint Tape. Width to adequately cover joint.
   a. Interior Gypsum Board: Paper.
   b. Exterior Gypsum Soffit Board: Paper.
   c. Glass-Mat Gypsum Sheathing Board: 10-by-10 glass mesh.
2. Joint Compound for Interior Gypsum Wallboard: For each coat use formulation that is compatible with other compounds applied on previous or for successive coats.
   a. Prefilling: At open joints and damaged surface areas, use setting-type taping compound.

b. Embedding and First Coat: For embedding tape and first coat on joints, fasteners, and trim flanges, use setting-type taping compound.
   1) Use setting-type compound for installing paper-faced metal trim accessories.
c. Fill Coat: For second coat, use setting-type, sandable topping compound.
d. Finish Coat: For third coat, use setting-type, sandable topping compound.
e. Skim Coat: For final coat of Level 5 finish, use setting-type, sandable topping compound.

3. Joint Compound for Tile Backing Panels:
   a. Water-Resistant Gypsum Backing Board: Use setting-type taping compound and setting-type, sandable topping compound.
   b. Cementitious Backer Units: Section 09 30 00.

D. Exterior Joint Treatment Materials: ASTM C475.

1. Joint Compound for Exterior Applications:
   a. Exterior Gypsum Soffit Board: Use setting-type taping compound and setting-type, sandable topping compound.
   b. Glass-Mat Gypsum Sheathing Board: As recommended by sheathing board manufacturer.

E. Additional Item: All additional accessories to complete work including nails and anchors to secure frames to walls and floors.

F. Extruded Corner Trim

1. Material: Extruded aluminum 1 ¼" legs with 7/8" joint receptor.
2. Basis of Design: FRY REGLET DMCT-1250
3. Other Manufacturers: ~~Equal products by~~ PITTCON or GORDON]

H. Acoustic Materials

1. Insulation: See Section 07 21 00.
2. Sealant: Nonsag, paintable, nonstaining latex sealant complying with ASTM C834. Product effectively reduces airborne sound transmission through perimeter joints and openings in building construction as demonstrated by testing representative assemblies according to ASTM E90.
   a. Manufacturers
      1) USG Acoustical Sealant
      2) TREMCO Acoustical Sealant
      3) PECORA BA-98
      4) BASF MasterSeal NP 520
   b. Acoustical joint sealant shall have a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
3. Neoprene impregnated sealant tape.

4. Head of Wall Insulation: Pre-manufactured, high-density mineral fiber acoustical insulation shaped to fit the trapezoidal flutes, typical of metal decking and complying with ASTM E119 as safing insulation.

J. Electrical / Acoustical Box Pads: Moldable Polybutene pads, minimum 1/8 inch thick. 3M Putty Pads, 3M FIRE PROTECTION PRODUCTS ~~or equal~~

PART 3 EXECUTION

3.01 PREPARATION

A. Provide adequate lighting and ventilation during installation and joint finishing treatment.

B. Coordination with Sprayed Fire-Resistive Materials

1. Before sprayed fire-resistive materials are applied, attach offset anchor plates or ceiling runners (tracks) to surfaces indicated to receive sprayed fire-resistive materials. Where offset anchor plates are required, provide continuous plates fastened to building structure not more than 24 inches o.c.
2. After sprayed fire-resistive materials are applied, remove them only to extent necessary for installation of non-load-bearing steel framing. Do not reduce thickness of fire-resistive materials below that required for fire-resistance ratings indicated. Protect adjacent fire-resistive materials from damage.

3.02 INSPECTION

A. Examine substrates and installation conditions. Do not proceed with gypsum wallboard work until unsatisfactory conditions have been corrected.

1. Protrusions of framing, twisted framing members, or unaligned members must be repaired before installation of wallboard is started.

B. Installation constitutes acceptance of existing conditions and responsibility for satisfactory performance.

3.03 FRAMING INSTALLATION

A. Comply with the requirements of ASTM C754 "Installation of Steel Framing Members to Receive Screw Attached Gypsum", and as specified.

B. Install tracks (runners) at floors and overhead supports. Extend framing full height to structural supports or substrates above suspended ceilings except where partitions are indicated to terminate at suspended ceilings. Continue framing around ducts penetrating partitions above ceiling.

1. Slip-Type Head Joints: Where framing extends to overhead structural supports, install to produce joints at tops of framing systems that prevent axial loading of finished assemblies.
2. Rated Stud Deflection Assembly: Install in accordance with manufacturer's instructions to provide required fire ratings. Ensure that anchoring devices, back-up material, clip supports and other materials are as used in referenced fire tests.
3. Securely attach runner to floor with expansion anchors or other approved means.

C. Install all framing plumb and square with spacing as indicated.

D. Provide supplementary framing, blocking, and bracing at terminations in gypsum board assemblies to support fixtures, equipment services, heavy trim, grab bars, toilet accessories, furnishings, or similar construction. Comply with details indicated and with recommendations of gypsum board manufacturer or, if none available, with United States Gypsum Company's "Gypsum Construction Handbook".

E. Bridging

1. Up to 10 ft. Wall Height: 1 row.
2. 10 ft. and Over Wall Height: 2 rows of bridging.

F. Provide a minimum of two (2) screws per connection.

3.04 FURRING INSTALLATION

A. Wall Application

1. Attach to masonry with expansion anchors or at mortar joints with concrete nails or expansion anchors.
2. Spacing shall be 16 in. o.c., unless otherwise indicated.
3. Run vertically or horizontally for maximum efficiency.

3.05 GYPSUM BOARD INSTALLATION

A. Gypsum Board Systems: Comply with ASTM C840.

B. General

1. Pre-installation Conference: Before start of gypsum board installation, meet at the project site with the Architect and installers of related work, including work requiring openings, chases, frames, access panels, support, similar integrated requirements and mechanical and electrical trades. Review potential interferences and conflicts and coordinate layout and sequencing requirements for proper installation and integration of the work.
   a. Do not proceed with gypsum board installation until blocking, framing, bracing and other supports for subsequently applied work

have been installed, reviewed and accepted by the Architect.

b. Do not install gypsum board until work concealed by gypsum board has been installed.

C. Application

1. Install gypsum board face side out. Do not install imperfect, damaged or damp boards.
2. Butt boards together for a light contact at edges and ends with not more than 1/16" open space between boards. Do not force into place.
3. Locate either edges or end joints over supports. Position boards so that both tapered edge joints abut. Do not place tapered edges against cut edges or ends. Stagger vertical joints over different studs on opposite sides of partitions.
4. Attach gypsum board to framing and blocking as required for additional support at openings and cutouts.
5. Floating Construction: Install gypsum board with "floating" internal corner construction, unless isolation of the intersecting board is indicated.
6. In addition to compliance with the standards, comply with specific requirements indicated for each type of arrangement of gypsum wallboard system shown. Space fasteners in accordance with manufacturer's recommendations and complying with referenced standards.
   a. Walls and Partitions: Apply sheets horizontally or vertically. Provide maximum sheet lengths to minimize end joints with edges or ends over supports. In two layer applications, stagger joints of second layer from joints of first layer.
   b. Cut and install panels to eliminate vertical joints in corners of door frames to ceiling.
   c. Make cutouts to fit within wall plate, register and grille flanged. All cutouts made by knife or saw.
   d. Make angles and corners clean, true, plumb and square; walls plumb, flat and straight and ceilings flat and level.
   e. Ceilings: Apply gypsum board on ceilings, before application on walls and partitions. Install in direction and manner to minimize end joints. Stagger end joints over supports. In two layer applications, stagger joints of second layer from joints of first layer.

3.06 EXTERIOR SHEATHING AND SOFFIT BOARD

A. Comply with GA-253 and with manufacturer's written instructions.

1. Install exterior sheathing board perpendicular to supports, stagger end joints over supports, use maximum lengths possible to minimize joints.
2. Install with 1/4 inch open space where boards abut other work.
3. Space screws 4 inches o.c. around perimeter of board and 8 inches o.c. on intermediate framing members and on diagonal braces. Locate fasteners minimum 3/8 inches from edges and ends of sheathing panels. Drive fasteners to bear tight against and flush with sheathing surface. Do not countersink.
4. Apply sealant around sheathing perimeter at interface with other materials.

5. Board Joints: Provide seam sealing tape or joint sealant at Contractor's option, as follows:
   a. Seam Sealing Tape, Horizontal Applications.
      1) Apply primer to joints and fasteners, allow to dry.
      2) Seal joints using tape specified herein or other similar type method recommended by board manufacturers for application indicated. Apply at time of sheathing, to sealed, dry, dust-free joints. Apply seam sealing tape along all edges, overlapping at intersections by width of tape.
      3) Apply sealant to exposed fasteners with a trowel so fasteners are completely covered.
      4) Seal other penetrations and openings.
      5) Coordinate sheathing and placement of through-wall flashing. Tape top of through-wall sealant to sheathing to provide a water-tight joint.
   b. Sealant
      1) Apply minimum 3/8" bead of sealant to joints and trowel to provide a layer approximately 2" wide by 1/16" thick spanning the joint. Apply enough to each fastener to cover completely when troweled flat. Use backer rod for openings larger than 1/8".
      2) Apply sealant to exposed fasteners with a trowel so fasteners are completely covered.
      3) Seal other penetrations and openings.
      4) Coordinate sheathing and placement of through-wall flashing. Tape top of through-wall flashing to sheathing to provide a water-tight joint.

3.07 INSTALLATION OF SOUND RATED PARTITIONS

A. Provide sound-rated construction where indicated.

B. Acoustic Insulation: Install single layer of acoustic batt insulation in designated partitions after one side of gypsum board is installed, filling width and height of partition completely. Attach to gypsum board with adhesive spots to prevent subsequent displacement.

C. Extend partition stud system through acoustical ceilings to substrate. Apply gypsum board base panels full height, both sides of partition.

D. Seal construction at perimeters, behind control joints, and at openings and penetrations with a continuous bead of acoustical sealant. Install acoustical sealant at both faces of partitions at perimeters and through penetrations. Comply with ASTM C919 and with manufacturer's written recommendations for locating edge trim and closing off sound-flanking paths around or through assemblies, including sealing partitions above acoustical ceilings.

E. Seal partition perimeters. Provide continuous beads of acoustical sealant at juncture of both faces of runners or plates with floor and ceiling construction and wherever work abuts dissimilar materials. Seal prior to installation of sound

attenuation insulation and gypsum board panels.

F. Provide continuous beads of sealant at juncture of gypsum board and abutting surface. Install gypsum board with 1/8" relief for sealant. Sealants to be contained within depth of gypsum board, not as a fillet.

G. At openings and cutouts, fill open spaces between edges of gypsum board and fixtures, cabinets, ducts, and other flush or penetrating items, with continuous bead of acoustical sealant.

H. If sound-rated partitions intersect non-sound-rated partitions, extend sound construction to completely close-off sound flanking paths through non-rated construction. Seal joints between face layers at vertical interior angles of intersecting partitions.

I. Exercise particular care at walls surrounding toilet areas and walls and ceilings surrounding mechanical spaces to provide properly constructed sound-rated gypsum board partition and ceiling systems.

J. Verify that electrical boxes are not located back-to-back; back-to back boxes to be offset at least one stud space. Do not close off non-complying conditions before notifying and receiving direction from Architect.

3.08 TRIM AND ACCESSORIES

A. Install corner beads at external corners of gypsum wallboard and sheathing work. Use longest practical lengths.

B. Install edge trim wherever edge of gypsum board or sheathing would be exposed or semi-exposed.

1. Provide beaded trim to receive joint compound at all gypsum wallboard work.
2. Provide L-type trim where work is abutted to other work and Kerf-type where work is kerfed to receive kerf leg.
3. Provide U-type trim where edge is exposed, revealed, gasketed or sealant filled, including expansion joints.

C. Attach to framing with steel drill screws. Clinch attachment to wallboard not acceptable.

D. Control Joints

1. Install control joints to isolate gypsum board surfaces as recommended by ASTM C840. Verify locations with Architect prior to installation. Generally locate joints as follows when:
   a. Partition, furring or column fireproofing abuts a structural element (except floor) or dissimilar wall or ceiling.
   b. Ceiling abuts a structural element, dissimilar wall or partition or other vertical penetration.

c. Construction changes within the plane of the partition or ceiling.
d. Partition or furring run exceeds 30'.
e. Ceiling dimensions exceed 50' in either direction with perimeter relief; 30' without relief.
f. Exterior ceilings and soffits exceed 20' in either direction; align with window mullions, when applicable.
g. Wings of "L", "U", and "T"-shaped ceiling areas are joined.
h. Expansion or control joints occur in the base exterior wall.
i. Differential Deflection Conditions: All locations where partitions are supported by two or more structural members and subject to differential deflection by live or dead loading:
1) Typical Framing Floor to Structure: Provide "Ceiling Deflection Track".
2) Framing over One Floor (stairs, shafts, etc.): Provide control joints where studs are interrupted by structure.
j. Partition terminations at window mullions.
1) Neoprene joint tape and caulking installed under Section 07 92 00. Provide break metal closure at partition end.
2) Adjustable aluminum mullion closures. GORDON Mullion Mate ~~or equal~~.

2. Provide framing immediately on both sides of joint and back with 2"+/- gypsum board strips as required to maintain fire resistance rating.

3.09 FINISHING

A. Comply with manufacturer's instructions for mixing, handling and application of materials. Apply treatment at joints both directions, at flanges of trim accessories, penetrations of gypsum board (electrical boxes, piping and similar work), fastener heads, surface defects and elsewhere indicated. Apply in manner that will result in each of these items being concealed when applied decoration has been completed.

B. Prefill open joints of more than 1/16" with special chemical-hardening type bedding compound, before bedding joint tape.

C. Apply joint tape at joints between gypsum boards, except where trim accessories are indicated.

D. Do not use topping compound for bedding joint tape.

E. Apply joint compound for the final coat of joint treatment, unless specifically recommended by the manufacturer for that use.

F. Walls Above Acoustical Ceiling Systems: Tape and fill joints with two coats of joint compound, sanding not required.

G. Leave all exposed surfaces smooth and even, ready for painting.

H. Provide where indicated on the drawings levels of finish as specified in ASTM C840, "Recommended Specification on Levels of Gypsum Board Finish". Levels

of finish consist of:

1. Level 1 - **Areas Above Ceilings**: All joints and interior angles shall have tape embedded in joint compound. Provide surface free of excess joint compound. Tool marks and ridges are acceptable.
2. Level 2 – **As a Substrate for Ceramic Tile**: All joints and interior angles to have tape embedded in joint compound and one separate coat of joint compound applied over all joints, angles, fastener heads, and accessories. Surface shall be free of excess joint compound. Tool marks and ridges are acceptable.
3. Level 4 – **All Areas Not Indicated to Receive Levels 1, 2 or 5**: All joints and interior angles to have tape embedded in joint compound and three separate coats of joint compound applied over all joints, angles, fastener heads, and accessories. All joint compound shall be smooth and free of tool marks and ridges.
4. Level 5 – **All Areas to Receive Semi-Gloss or Gloss Coatings**: All joints and interior angles to have tape embedded in joint compound and three separate coats of joint compound applied over all joints, angles, fastener heads, and accessories. A thin skim coat of joint compound, or a material manufactured especially for this purpose, shall be applied to the entire surface. Excess material is to be removed leaving a film covering over the gypsum board paper surface.

3.10 ADJUST AND CLEAN

A. Remove any screw which does not engage into a framing member or spins freely.

B. When paper face is punctured, drive new screw approximately 1-1/2" from defective fastener and remove defective fastener. Fill damaged surface with compound.

C. Ridging

1. Do not repair ridging until condition has fully developed: approximately 6 months after installation or one heating season.
2. Sand ridges to reinforcing tape without cutting through tape.
3. Fill concave areas on both sides of ridge with topping compound.
4. After fill is dry, blend in topping compound over repaired area.

D. Fill cracks with compound and finish smooth and flush.

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

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

3.11 PROTECTION

A. Protect adjacent surfaces from drywall compound and promptly remove from floors and other non-drywall surfaces. Repair surfaces stained, marred, or otherwise damaged during drywall application.

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

END OF SECTION

SECTION 09 30 00

TILE

PART 1 GENERAL

1.01 WORK INCLUDED

A. Extent of tile work is shown on drawings and schedules, and as specified herein.

B. Types of tile work required including the following:

1. Porcelain wall tile, floor tile and base.
2. Backer board.

C. Section also includes:

1. Crack-suppression membrane for thin-set tile installations.
2. Metal edge/transition strips installed as part of tile installations.

1.02 RELATED SECTIONS

A. Sealant: Section 07 92 00.

B. Concrete slab preparation: Section 01 73 00.

C. Sustainable Design Requirements: Section 01 81 13.

D. VOC Limits: Section 01 81 16.

1.03 QUALITY ASSURANCE

A. Manufacturer: Provide tile of each type produced by a single manufacturer. Provide materials obtained from one source for each type and color of tile, grout, and setting materials.

B. Installer: A firm with not less than 5 years experience in installing tile in applications similar to those required for this work.

C. Ceramic Tile Manufacturing Standard: TCA 137.1. Furnish tile complying with Standard Grade requirements unless indicated otherwise.

D. Proprietary Materials: Handle, store, mix and apply proprietary setting and grouting materials in compliance with manufacturer's instructions.

E. Installer to verify locations of all flexible joints required by the provisions of this section, by the recommendations of TCA, and by the recommendations of the related manufacturers. See Article 3.06.

1. Joint locations may or may not be indicated on the drawings.

F. ANSI Standards for Tile Installation Materials: Provide materials complying with ANSI A108.02, ANSI standards referenced in other Part 2 articles, ANSI standards referenced by TCNA installation methods specified in tile installation schedules, and other requirements specified.

1.04 PERFORMANCE REQUIREMENTS

A. Dynamic Coefficient of Friction: For tile installed on walkway surfaces subject to traffic while wet, provide products with a dynamic coefficient of friction not less than 0.42 as determined by testing identical products per ANSI A137.1.

1.05 SUBMITTALS

A. Product Data: Submit manufacturer's technical information and installation instructions for materials required. Include certifications and other data to show compliance with these specifications.

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: Submit manufacturer's color charts consisting of actual tiles or sections of tiles showing full range of colors available, for each type of tile specified. Include samples of grout and accessories requiring color selection. Submit full size sample for each type of trim, accessory and color. Submit samples of metal edge strip.

D. Certification: Furnish Master Grade Certificate for each type of tile, signed by manufacturer and Installer.

E. Sustainable Design Documentation Submittals: Comply with Section 01 81 13.

1. VOC Limits: Include documentation verifying product Low Emitting Material Building Product Disclosures and Optimization.

1.06 PRODUCT HANDLING

A. Deliver packaged materials and store in original containers with seals unbroken and labels intact until time of use, in accordance with manufacturer's instructions.

1.07 JOB CONDITIONS

A. Maintain environmental conditions and protect work during and after installation in accordance with referenced standards and manufacturer's printed recommendations.

PART 2 PRODUCTS

2.01 CERAMIC TILE

A. Ceramic Wall Tile, Floor Tile and Base: Standard grade, impervious porcelain ceramic tile conforming to ANSI 137.1. Provide trim pieces as required.

B. Manufacturer

1. Basis of Design: Manufacturer, Styles and Colors: As indicated on the drawings.
2. Other Acceptable Manufacturers: Ceramic tile manufactured by other manufacturers will be considered if materials meet the requirements of the Basis of Design and the sizes and colors are an acceptable match as approved by the Architect.

2.02 MORTAR, GROUT AND ACCESSORIES

A. Source: Setting mortar and grout to be from same manufacturer.

1. Adhesives, Epoxies, Mortar and Grout Manufacturers: CUSTOM BUILDING PRODUCTS, BOSTIK, MAPEI, LATICRETE, BOSTIC, TEC (H.B. FULLER) and BONSAL AMERICAN.
   a. Manufacturer's listed under the following applications are for basis of design. ~~Equal~~ products by above listed manufacturers are acceptable.

B. General - All Adhesives, Epoxies, Mortar and Grout: See Tile Installation Systems in Part 3 of this Section.

1. Provide materials that comply with Project Sustainable Design Requirements and Low Emitting Material goals.

C. Modified Dry Set Cement Mortar - Thin Set: Factory mixed mortar of Portland cement/sand, field gauged with undiluted latex admixture. Conform to ANSI A118.4, Latex-Portland Cement Mortar. Provide type suitable for “medium-set” for tiles with a dimension larger than 15”.

1. Provide one of the following:
   a. BOSTIK, Durabond D-50 or D-60.
   b. MAPEI, Ultraflex 3.
   c. CUSTOM BUILDING PRODUCTS, ProLite Tile and Stone Mortar
   d. LATICRETE, 255 MultiMax.
2. Thinset Mortar for Glass Tile: Complies with ANSI A118.4 and A118.11.
   a. BOSTIC Glass-Mate Glass Tile Mortar with Admixture Product 425TM Multi-Purpose Acrylic Latex Admixture.
   b. CUSTOM BUILDING PRODUCTS, VersaBond Professional Thin Set Mortar
   c. **Products** by MAPEI or LATICRETE

D. Dry-Set Mortar - Thin Set: Mixture of Portland cement with sand and latex, water

imparting additive. Conform to ANSI A118.1, Standard Dry-Set Cement Mortar.

1. May be used in lieu of Modified Dry Set Cement Mortar for ceramic floor and wall tile.

E. Grout - Ceramic Tile (ANSI A118.7): Integrally colored, sanded (unless otherwise indicated), polymer modified cement type, factory prepared (premixed) grout. Color as selected by Architect.

1. Provide one of the following:
   a. BOSTIC, Ceramic Tile Grout with BOSTIK 425 Acrylic-Latex Admixture.
   b. TEC (H.B. FULLER), TEC Power Grout.
   c. MAPEI, Ultracolor.
   d. LATICRETE, Permacolor Grout.
   e. CUSTOM BUILDING PRODUCTS, Prism
2. Colors: As selected by Architect.
3. Provide unsanded grout for glass tile and tile joints less than 1/8” wide.

F. Crack Isolation (Anti-Fracture) Membrane: Fabric-Reinforced, Modified-Bituminous Sheet: Self-adhering, modified-bituminous sheet with fabric reinforcement facing; 0.040-inch nominal thickness. ANSI A118.12.

1. Products: Provide one of the following:
   a. MAPEI CORPORATION; Mapelastic SM.
   b. NATIONAL APPLIED CONSTRUCTION PRODUCTS, INC.; Strataflex.
   c. POLYGUARD; Tileguard.
   d. CUSTOM BUILDING PRODUCTS, Crack Buster Pro.

G. Metal Edge Trim: L-shape, height to match tile and setting-bed thickness; stainless steel, ASTM A666, 300 Series. SCHLUTER, CERAMIC TOOL COMPANY, BLANKE

H. Grout Sealer: Low VOC, penetrating type as recommended by grout manufacturer that does not change color or appearance of grout.

2.03 TILE BACKER BOARD

A. Description: Nominal 1/2" thick cementitious board with fiberglass mesh reinforcements conforming to the requirements of ANSI A118.9.

1. Provide cadmium plated screws, type as recommended by board manufacturer.
2. Joint Treatment Tape: 2" wide, 10x10 glass mesh type or similar type as recommended by board manufacturer.

B. Manufacturer: Wonder Board by MODULARS, INC.; Util-A-Crete by FIN PAN; Durock Interior Tile Backer Board by U.S. GYPSUM; Dens-Shield by GEORGIA PACIFIC, CUSTOM BUILDING PRODUCTS, WonderBoard Lite Backerboard.

PART 3 EXECUTION

3.01 INSPECTION

A. Examine surfaces to receive tile, setting beds and accessories before tile installation for the following:

1. Defects or conditions adversely affecting quality and execution of the installation.
2. Deviations beyond allowable tolerances of surfaces to receive tile.
3. Do not proceed with installation work until unsatisfactory conditions are corrected.

B. Conditions of surfaces to receive tile.

1. Surfaces to be firm, dry, clean, and free of oily or waxy films or curing compounds.
2. Grounds, anchors, plugs, hangers, bucks, electrical, plumbing and HVAC work in or behind tile to be installed prior to proceeding with tile work.

3.02 PREPARATION

A. Prepare surfaces to receive tile as required to achieve proper bond and as recommended by the Tile Council of America.

1. See Section 01 73 00 for additional floor preparation requirements.

B. Fill cracks, low areas and pits in concrete with self-leveling fill of type recommended by tile manufacturer for substrate conditions encountered.

C. Lightly grind concrete subfloors with a terrazzo grinder to remove trowel marks, slab curl at saw cut joints or other surface irregularities or high spots which will telegraph to the flooring surface.

D. Sawcut or grind transition areas to install tile flush with adjacent finished floor materials.

E. Clean surfaces in a manner suitable for proper installation. Verify that slabs are free of curing membranes, oil, grease, wax, dust and other materials deleterious to tile installation.

F. Primers or other preparations required or recommended in accordance with manufacturer's instructions.

3.03 TILE BACKERBOARD

A. Location: Provide tile backerboard on metal stud walls as a substrate for ceramic tile products specified herein which are located on toilet room wet walls.

B. Install in strict accordance with manufacturer's recommendations and ANSI A108.11, Interior Installation of Cementitious Backer Units.

1. Butt ends and edges of adjacent panels.
2. Attach with screws spaced at 6 inch centers on perimeter and field.
   a. Maintain minimum 1/2 inch from screws to panel edge.
   b. At wainscot or similar location where tile terminates in same plane of wall, shim tile backerboard flush with adjacent wall board. Provide shims continuous along face of studs.
3. Locate control and expansion joints in same locations as substrate and where required by wall tile.
4. Apply glass mesh tape, or type recommended by board manufacturer, over joints. Embed tape in setting material indicated for specified tile finish.

3.04 INTERIOR WALL TILE INSTALLATION - SYSTEMS

A. Prepare surfaces, fit, set or bond, grout, and clean in accordance with Tile Council of America, "Handbook for Ceramic Tile Installation", 2019 Edition; and as follows:

B. Thin Set - Stud Walls - Over Tile Backerboard: TCA W244, dry-set mortar bond coat or latex Portland cement bond coat and grout.

1. Tile: ANSI A108.5.
2. Grout: ANSI A108.10.
3. Backerboard
   a. Joint Preparation: Fill joints completely with setting mortar and embed 2 inch wide coated fiberglass tape into skim coat of same mortar.
   b. Apply setting mortar in one layer, troweling skim coat with trowel's flat edge and then texturing with appropriate notched trowel. Troweling equipment must be appropriate for type of tile work and in good condition.

C. Thin Set - Stud Walls - Over Gypsum Board: TCA W243, dry-set mortar bond coat or latex Portland cement bond coat and grout.

1. Tile: ANSI A108.5.
2. Grout: ANSI A108.10.

3.05 INTERIOR FLOOR TILE INSTALLATION - SYSTEMS

A. Prepare surfaces, fit, set or bond, grout, and clean in accordance with Tile Council of America, "Handbook for Ceramic Tile Installation", 2019 Edition; and as follows:

B. Thin Set: TCA design F113, latex Portland cement mortar and grout or dry-set mortar and grout.

1. Tile: ANSI A108.5.
2. Grout: ANSI A108.10.

C. Thin Set, Adhesive: TCA F116; organic adhesive and grout.

1. Tile: ANSI A108.4.
2. Grout: ANSI A108.10.

3.06 TILE INSTALLATION - PROCEDURES

A. Comply with TCA's "Handbook for Ceramic Tile Installation" for TCA installation methods specified in tile installation schedules. Comply with parts of the ANSI A108 Series "Specifications for Installation of Ceramic Tile" that are referenced in TCA installation methods, specified in tile installation schedules, and apply to types of setting and grouting materials used.

1. For the following installations, follow procedures in the ANSI A108 Series of tile installation standards for providing 95 percent mortar coverage:

B. All tiles are to be subjected to thermal cycling prior too installation.

C. Extend tile work into recesses and under or behind equipment and fixtures, to form a complete covering without interruptions, except as otherwise shown. 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 that plates, collars or covers overlap tile.

E. Placement Methods: Install tile using the hereinbefore specified setting beds and grouts.

F. Jointing Pattern: Unless otherwise shown, lay tile in grid pattern. Align joints when adjoining tiles on floor, base, walls and trim are same size. Layout tile work and center tile fields in both directions in each space or on each wall area. Adjust to minimize tile cutting.

1. Avoid tile layout with less than half width tiles at room/area perimeters, unless otherwise indicated on the floor layout drawings. Notify Construction Manager if layout not achievable per layout indicated on the drawings. Do not continue in room/area in question until approved by the Associate.
2. Provide uniform joint widths, unless otherwise shown.
    a. Ceramic Mosaic Tile: 1/16 inch.
    b. Quarry Tile: 1/4 inch
    c. Large format Floor Tile: 1/8 inch.
    d. Glazed Wall Tile: 1/16 inch.
3. Multiple Tile Face Size: Where indicated tile pattern contains multiple tile face sizes, coordinate with Architect to provide uniform joint with size.

G. Anti-Fracture Membrane: Install over floor cracks, cold-joints and sawed joints.

Discontinue at expansion joints. Install in compliance with ANSI 108.17 and manufacturer's instructions and recommendations. Seam joints as recommended by manufacturer. Conform to TCA F125. Coordinate with flexible joints specified in Article 3.07, Flexible Joints.

3.07 FLEXIBLE JOINTS

A. Locate flexible joints (expansion, control and isolation joints) prior to tile installation. See Quality Assurance in Part 1 herein.

B. Provide flexible joints as specified herein, unless more stringent requirements are indicated on drawings. Provide as specified, regardless if not indicated on drawings.

C. Joint to be continuous from face of tile to bottom of setting bed or leveling bed. Reinforcing to be discontinued at joint. Install continuous joint filler material in joint from setting or leveling bed to a point below face of tile adequate for proper placement of backing rod and sealant.

D. Joint Design: TCA design EJ171 as applicable. See Section 07 92 00 for sealant. Provide at the following locations:

1. Horizontal Surfaces
    a. Directly over expansion joints.
    b. Over anti-fracture membrane which is applied over structural slab cold joints, construction joints and control joints.
    b. Where tile work abuts restraining surfaces such as perimeter walls, curbs, columns, pipes, etc.
    c. Floor areas exceeding 12 feet in any direction for exterior work and 24 feet in any direction for interior work.
    d. Other locations where indicated.
2. Vertical Surfaces
    a. Directly over joints in wall substrate including cold joints, construction joints, control joints and expansion joints.
    b. At changes in substrate material.
    c. Where tile work abuts restraining surfaces such as perimeter walls, curbs, columns, pipes, etc.
    d. Where indicated.

E. Curing: Cure tile floor, base, and wall installations in accordance with manufacturer's recommendations, TCA recommendations, and in accordance with ANSI requirements.

F. Metal Edge Strips: Provide metal edge strips at openings without thresholds, and where exposed edges of tile floors meet other materials.

1. Except as otherwise indicated, where trim is located across door openings, locate trim on the door side in line with the edge of the door stop, terminating at the rabbet.

3.07 REPAIR, CLEAN AND PROTECT

A. Repair, or remove and replace chipped, damaged or otherwise defective work to the satisfaction of the Architect.

B. Cleaning: Upon completion of placement and grouting, clean all tile surfaces so that they are free of foreign matter.

1. Use methods and materials as recommended by tile manufacturer.
2. Replace tiles that cannot be satisfactorily cleaned.

C. Grout Sealer: Apply silicone grout sealer to grout joints according to grout sealer manufacturer's written instructions. As soon as grout sealer has penetrated grout joints, remove excess sealer from joints and from tile faces by wiping with soft cloth.

D. Protection: When recommended by tile manufacturer, apply a protective coat of neutral protective cleaner to completed tile walls and floors. Protect installed tile work with Kraft paper or other heavy covering during construction period to prevent damage and wear.

1. Prohibit foot and wheel traffic from using tiled floors for at least 3 days after grouting is completed.
2. Before final inspection, remove protective coverings and rinse neutral cleaner from tile surfaces.

END OF SECTION

SECTION 09 51 13

ACOUSTICAL PANEL CEILINGS

PART 1 GENERAL

1.01 WORK INCLUDED

A. Provide acoustical lay-in panel ceiling system as shown and specified.

1.02 RELATED SECTIONS

A. Gypsum Board Ceiling: Section 09 21 16.

B. Sustainable Design Requirements: Section 01 81 13.

C. VOC Limits: Section 01 81 16.

1.03 QUALITY ASSURANCE

A. Workmanship: Comply with Ceilings & Interior Systems Contractors Association (CISCA) “Ceiling Systems Handbook”.

B. Installation: Performed by an experienced authorized installer approved by acoustical material manufacturer.

C. Fire Hazard Classification: Provide acoustical materials which have been UL tested, listed and labeled Class 0-25, when tested in accordance with ASTM E84, Class A flame spread rating in accordance with ASTM E1264 requirements.

D. Reference Standards: Wherever the following abbreviations are used herein, they shall refer to the corresponding standards.

1. AIMA: Acoustical and Insulating Materials Association.
2. ASTM: American Society for Testing and Materials.
3. CISCA: Ceilings and Interior Systems Contractors Association.

E. Coordination Between Trades: Quality assurance includes the cooperation with HVAC, Plumbing and Electrical Contractors in regards to ceiling grid layout.

1. Procedures for submitting coordination drawings for ceiling work is included in Section 01 33 23 - Shop Drawings, Product Data and Samples.

1.04 SUBMITTALS

A. Product Data

1. Submit manufacturer's product data and installation instructions for each

type of acoustical material and suspension system required.

2. Submit manufacturer's written instructions for recommended maintenance practices for each type of acoustical ceiling system required. Include recommendations for cleaning and refinishing acoustical units and precautions against materials and methods that may be detrimental to finishes and acoustical performances.

B. Samples: Submit 12" square acoustical panel samples for each type of acoustical unit required. Provide 12" long suspension system and edge molding samples.

C. Certification: Submit manufacturer's certification of acoustical units fire hazard classification rating and performance requirements.

D. Sustainable Design Documentation Submittals: Comply with Section 01 81 13.

1. VOC Limits: Include documentation verifying product Low Emitting Material Building Product Disclosures and Optimization.

1.05 PRODUCT DELIVERY, STORAGE AND HANDLING

A. Deliver materials in original, unopened protective packaging, with manufacturer's labels indicating brand name, pattern size, thickness and fire rating as applicable, legible and intact.

B. Store materials in original protective packaging to prevent soiling, physical damage or wetting.

C. Store cartons open at each end to stabilize moisture content and temperature.

D. Do not begin installation until sufficient materials to complete a room are received.

1.06 PROJECT CONDITIONS

A. Environmental Limitations: Do not install acoustical panel ceilings until spaces are enclosed and weatherproof, wet work in spaces is complete and dry, work above ceilings is complete, and ambient temperature and humidity conditions are maintained at the levels indicated for Project when occupied for its intended use.

1.07 EXTRA MATERIALS

A. Maintenance Stock: Under this Section furnish to the Owner prior to final acceptance, extra maintenance stock of acoustical materials, consisting of a minimum of one percent of area of each size, type, thickness installed on the job, and 4% if the area is under 5,000 sq. ft. This extra stock is for the Owner's use after completion of the Project and is not to be used for repair or replacement required during the construction period. Properly package, seal, and identify extra stock material.

PART 2 PRODUCTS

2.01 SUSPENSION SYSTEM

A. Exposed "Tee" Grid System

1. Description: Cold-rolled electrogalvanized steel, factory applied white finish paint to match ceiling tile.
   a. 9/16” exposed face; ARMSTRONG Suprafine; DONN (USG INTERIORS) Fineline; ROCKFON Chicago Metallic Tempra 4000.
2. Description: Comply with ASTM C635. Provide systems adequate to support light fixtures, ceiling diffusers, and other normal accessories. Maximum deflection 1/360 of the span. All components of system from one manufacturer, die cut, and interlocking.
   a. Structural Class: Intermediate duty.
   b. Type of System: Direct Hung.
   c. Attachment Devices: Size for five times design load indicated in ASTM C635, Table 1 direct hung.
   d. Hanger Wires: ASTM A641 galvanized carbon steel, soft temper, prestretched not less than 12 gauge.
   e. Carrying Channels: 1-1/2" steel channels, hot-rolled or cold-rolled, not less than 0.475 lbs per linear foot, standard finish.
   f. Members: Provide manufacturer's standard exposed runners, cross runners and accessories of type and profiles indicated, with exposed cross runners coped to lay flush with main runners.

3. Edge Moldings: Hemmed edge wall angles, cold-rolled electrogalvanized steel, factory applied finish to match grid system. Provide width, configuration and profile indicated.

2.02 ACOUSTICAL UNITS

A. General

1. Cellulose Base
   a. Toxicity/IEQ: Panel based anti-microbial treatment to inhibit growth of mold and mildew:
      1) Coating-Based Antimicrobial Treatment: Provide acoustical panels with face and back surfaces coated with antimicrobial treatment; and showing no mold or mildew growth when tested in accordance with ASTM D3273.
      2) Panel-Based Antimicrobial Treatment: Provide acoustical panels manufactured with antimicrobial treatment in the panels.
2. Mineral Base
   a. Toxicity/IEQ: Panel based anti-microbial treatment to inhibit growth of mold and mildew:
      1) Coating-Based Antimicrobial Treatment: Provide acoustical panels with face and back surfaces coated with antimicrobial treatment; and showing no mold or mildew growth when tested in accordance with ASTM D3273.
      2) Panel-Based Antimicrobial Treatment: Provide acoustical panels manufactured with antimicrobial treatment in the

panels.

B. Acceptable Manufacturers: The following models listed are by ARMSTRONG. ~~Equal~~ products by CERTAINTEED, ROCKFON or U.S. GYPSUM are acceptable.

C. Type ACT-1: Cirrus #1912, 24” x 24” x ¾”, beveled tegular edge, NRC .75, CAC 35, light reflectance LR-.90, with white, washable finish; 9/16” grid.

PART 3 EXECUTION

3.01 INSPECTION

A. Examine substrates, structure and installation conditions. Do not proceed with acoustical ceiling systems work until unsatisfactory conditions have been corrected.

B. Installation constitutes acceptance of existing conditions and responsibility for satisfactory performance.

3.02 PREPARATION

A. Measure each ceiling area and establish layout of acoustical units to balance border widths at opposite edges of each ceiling.

1. Avoid use of less than half widths units at borders.

B. Coordinate with ceiling layout on drawings.

C. Notify Architect of discrepancies between ceiling layout on drawings and ceiling layout proposed. Do not proceed until approved by Architect.

3.03 INSTALLATION

A. Suspension System: Comply with ASTM C636 requirements and be water or laser leveled, maximum deflection of 1/360 of span and maximum surface leveling tolerance 1/8" in 12'-0".

B. Rough Suspension

1. Hangers: Ceiling suspension systems shall not be supported from ductwork, electrical conduit, heating or plumbing lines or any other utility lines. Each utility and the ceiling suspension system shall be a separate installation and each shall be independently supported from the building structure. Where interferences occur, employ trapeze hangers or supports to avoid interferences with appurtenances requiring servicing. Support all four corners of suspension systems at fluorescent light fixtures.
2. Wall Molding
   a. Provide edge trim molding at perimeter of acoustical ceiling installation and intermediate vertical surfaces. Use maximum lengths. Miter trim corners to provide tight, accurate joint. Connect

moldings securely to substrate surfaces.

b. Connect moldings to substrate at intervals not over 16" on center and not more than 3" from ends, leveling with ceiling suspension system to tolerance of 1/8" in 12'-0".

C. Acoustical Units

1. Install acoustical lay-in panels level, in uniform plane, with joints accurately cut to ensure a snug and square fit. All panel faces and edges to be free from damage or soiling.
   a. Fit border units accurately at borders and penetrations.
   b. Recreate tegular and decorative edges at wall cuts and other cuts.
   c. For square-edged panels, install panels with edges fully hidden from view by flanges of suspension-system runners and perimeter moldings.
   d. For reveal-edged panels on suspension-system runners, install panels with bottom of reveal in firm contact with top surface of runner flanges.
   e. For reveal-edged panels on suspension-system members with box-shaped flanges, install panels with reveal surfaces in firm contact with suspension-system surfaces and panel faces flush with bottom face of runners.
   f. Paint cut edges of panel remaining exposed after installation; match color of exposed panel surfaces using coating recommended in writing for this purpose by acoustical panel manufacturer.
2. Coordinate suspension systems grid layout with electrical lighting fixture lay-out and installation.

3.04 CLEANING

A. After installation, clean soiled or discolored surfaces of acoustical units and exposed suspension members. Comply with manufacturer's recommendations for cleaning and touch-up of minor finish damage.

B. Adjust all sags and twists which develop in ceiling systems. Remove and replace units which are improperly installed and damaged units which cannot be successfully cleaned and repaired to eliminate evidence of damage.

END OF SECTION

SECTION 10 26 00

WALL PROTECTION

PART 1 GENERAL

1.01 WORK INCLUDED

A. Work under this section includes the following:

1. Resilient sheet wall covering

1.02 RELATED SECTIONS

A. Sustainable Design Requirements: Section 01 81 13.

B. VOC Limits: Section 01 81 16.

1.02 REFERENCE STANDARDS

1. ADA 4.4, 4.26 - Americans with Disabilities Act.
2. ASTM E84 - Surface Burning Characteristics of Building Materials.
3. UL - Underwriters Laboratories Classifications.

1.03 QUALITY ASSURANCE

A. Manufacturer: Firm with minimum five years experience in successfully producing wall guards and wall panels similar to that indicated for this project.

B. Installer qualifications: Engage an installer who has no less than 3 years experience in installation of systems similar in complexity to those required for this project.

C. Fire performance characteristics: Provide engineered PETG wall protection system components with UL label indicating that they are identical to those tested in accordance with ASTM E84 for Class 1 characteristics listed below:

1. Flame spread: 25 or less
2. Smoke developed: 450 or less

D. Impact Strength: Provide assembled wall protection units that have been tested in accordance with the applicable provisions of ASTM F476.

E. Chemical and stain resistance: Provide wall protection system components with chemical and stain resistance in accordance with ASTM D543.

F. Single source responsibility: Provide all components of the wall protection system manufactured by the same company to ensure compatibility of color, texture and physical properties.

1.04 SUBMITTALS

A. Submit the following in accordance with Section 01 33 23.

B. Shop Drawings: Clearly indicate the following for each type of wall protector:

1. Type of wall protector identified by manufacturer's model numbers including profiles, sizes, accessories and finish.
2. Types and sizes of wall anchors for each type of wall construction.

C. Samples: 6" long full size samples representative of each type of wall protector specified.

D. Manufacturer's certification indicating compliance with ADA Accessibility Guidelines for Protruding Objects.

1.05 DELIVERY, HANDLING AND STORAGE

A. Products shall be delivered to job-site in original unopened packages bearing manufacturer's labels.

B. Store and protect products in accordance with manufacturer's recommendations.

PART 2 PRODUCTS

2.01 RESILIENT WALL PANEL

A. Description: Vinyl/acrylic sheet (.040")

1. Color: As selected by Architect.
2. Trim and Joint Moldings: Extruded rigid plastic that matches wall-covering color.
3. Mounting: Adhesive.

B. Manufacturer: As indicated. **Products** by DECOGARD PRODUCTS or ~~equal~~ by BALCO METALINES, KOROSEAL, PAWLING or IPC CONSTRUCTION SPECIALTIES, INC

2.02 MATERIALS

A. Plastic Materials: Chemical- and stain-resistant, high-impact-resistant plastic with integral color throughout; extruded and sheet material as required, thickness as indicated.

B. Adhesives: As recommended by protection product manufacturer. Provide and comply with project VOC and sustainability requirements.

2.03 FABRICATION

A. Fabricate wall and door protection according to requirements indicated for design, performance, dimensions, and member sizes, including thicknesses of components.

B. Factory Assembly: Assemble components in factory to greatest extent possible to minimize field assembly. Disassemble only as necessary for shipping and handling.

C. Quality: Fabricate components with uniformly tight seams and joints and with exposed edges rolled. Provide surfaces free of wrinkles, chips, dents, uneven coloration, and other imperfections. Fabricate members and fittings to produce flush, smooth, and rigid hairline joints.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verification of conditions: Examine areas and conditions under which work is to be performed and identify conditions detrimental to proper or timely completion.

1. Do not proceed until unsatisfactory conditions have been corrected.

3.02 PREPARATION

A. Surface preparation: Prior to installation, clean substrate to remove dirt, debris and loose particles. Perform additional preparation procedures as required by manufacturer’s instructions.

B. Protection: Take all necessary steps to prevent damage to material during installation as required in manufacturer’s installation instructions.

3.03 INSTALLATION

A. Install items in accordance with manufacturer's instructions and directions.

B. General: Install impact-resistant wall protection units level, plumb, and true to line without distortions. Do not use materials with chips, cracks, voids, stains, or other defects that might be visible in the finished Work.

1. Provide splices, mounting hardware, anchors, and other accessories required for a complete installation.
2. Where splices occur in horizontal runs of more than 20 feet, splice aluminum retainers and plastic covers at different locations along the run, but no closer than 12 inches.
3. Adjust termination caps as required to ensure tight seams.

C. Impact-Resistant Wall Covering: Install top and edge moldings, corners, and divider bars as required for a complete installation.

3.04 CLEANING

A. Remove protective material from all wall protectors and clean in accordance with manufacturer's recommendations.

B. Remove surplus materials, rubbish and debris resulting from installation as work progresses and upon completion of work.

3.05 PROTECTION

A. Protect installed materials to prevent damage by other trades. Use materials that may be easily removed without leaving residue or permanent stains.

END OF SECTION

SECTION 10 28 13

TOILET ACCESSORIES

PART 1 GENERAL

1.01 SCOPE

A. This section covers all toilet accessories. Extent of each type of accessory is indicated on the drawing and specified herein.

B. Included are accessories for:

1. Toilet rooms.
2. Locker/Shower rooms.
3. Janitor rooms.
4. Kitchens, Break Rooms and similar areas with sinks.
5. Laboratories.

C. Coordinate toilet partition mounted items with partition manufacturer for proper fastener reinforcements.

1.02 WORK SPECIFIED IN OTHER SECTION

A. Unframed Mirrors: Section 08 81 00.

1.03 QUALITY ASSURANCE

A. Provide each type of products of one manufacturer. Provide locks with same keying for all accessory units in the project.

B. Stamped names or labels on exposed faces of units not permitted.

1.04 SUBMITTALS

A. Submit manufacturer's product data and installation instructions for each type of toilet accessory required.

1.05 DELIVERY, STORAGE AND HANDLING

A. Delivery accessory items in manufacturer's original, unopened packaging.

B. Store and handle materials in accordance with manufacturer's recommendations. Protect against soiling, damage and wetting.

1.06 PROJECT CONDITIONS

A. Furnish anchoring devices and inserts for installation of toilet accessories. Coordinate delivery of items which must be set or built into other work.

B. Provide setting drawings, templates and instructions for installation of anchorage devices.

1.07 WARRANTY

A. Submit mirror manufacturer's written ten year warranty against silver spoilage.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Where a manufacturer's product is specified as a Basis of Design, ~~equal~~ products as manufactured by BOBRICK, BRADLEY, AJW, AMERICAN SPECIALTIES, may be used provided the product meets the requirements of the specifications, unless otherwise indicated.

2.02 ITEMS

A. Toilet Paper Holder: ADA compliant, open non-controlled.

1. Double Roll: BOBRICK B-6867 and B-6977

a. Type: Provide recessed mount where possible.
b. Finish: Satin stainless steel.

B. Soap Dispenser - ADA compliant Vertical Tank Type: BRADLEY Model 6562-73

1. Type: Surface mounted, liquid dispenser.
2. Material: Stainless Steel, 20 ga., type 304.
3. Finish: Satin.
4. Capacity: 40 oz.

C. Handicap Bars: BRADLEY Series 812

1. Diameter: 1-1/2 inch.
2. Material: Stainless steel, standard satin finish.
3. Fasteners: Concealed.
4. Style and Length
   a. As indicated; where not indicated provide 42” long horizontal and 18” vertical bars.
   b. Provide both horizontal and vertical bars in conformance with ANSI A117.1, 604, 608 and 609.

D. Paper Towel Dispenser: BRADLEY Model 2494

1. Type: Sensor activated surface mount with lockable hinged front cover.
2. Capacity: Dispenses non-perforated roll towels up to 8" in diameter and

8" wide with core sizes from 1½"–2". Dispenser shall allow for 3" diameter stub roll
3. Material: transluscent high impact plastic.
4. Unit to be capable of being combined with waste receptacle to create a multi-purpose cabinet.

E. Sanitary Napkin Disposal: BRADLEY Model 4781-15.

1. Type: Surface mounted on toilet partition. Hinged bottom for disposable liner removal.
2. Material: Stainless steel, satin finish.

F. Sanitary Napkin/Tampon Dispenser: BRADLEY Model 4017.

1. Type: Recessed, coin operated (25 cent operation).
2. Material: Stainless steel, satin finish.
3. Capacities
   a. Sanitary Napkins: 30.
   b. Tampons: 28.

G. Robe/Towel Hook: BRADLEY Model 9119-81

1. Type: Wall mounted, concealed fastener.
2. Material: Chrome plated brass. Satin chrome finish.

H. Mirrors

1. Standard Framed Type: BRADLEY Model 780.
   a. Frame: Stainless steel angle, theft resistant concealed fasteners.
   b. Glass: Tempered 1/4" thick with full silver coating, copper coating and organic coating. Warranted by manufacturer 10 years against silver spoilage.
   c. Size: 18" wide x 36" high, unless otherwise indicated or scheduled on the drawings.

J. Mop Strip: BRADLEY Model 9953.

1. Description: Stainless steel, satin finish back plate with three spring activated rubber cam mop holders.
2. Location: Provide at each janitors sink. Coordinate height with Architect.

K. Infant Changing Table

1. Description: Surface mount, fold down type. Concave molded polyethylene changing surface with safety strap. Folds up flat against wall when not in use. Provide with integral sanitary liner holder.
   a. Sanitary Liners: Provide 2 cases (approximately 2,800) disposable liners.
2. Manufacturer Koala Bear Kare Horizontal Baby Changing Station by KOALA CORPORATION or ~~equal~~ by BROCAR PRODUCTS, FOUR D,

INC. or other manufacturers listed in Article 2.01.

2.03 FABRICATION

A. Edges: All throat openings and similar type exposed edges of towel dispensers, seat cover dispensers, waste receptacles and similar type accessories to be hemmed or sufficiently rounded to preclude accidental cuts to users.

B. Miters: Provide one-piece seamless beveled or return flange; open miters, if not welded, must be worked to eliminate sharp edges; edges which may cut or snag are not acceptable.

2.04 SCHEDULE OF ACCESSORIES

A. Location, quantity and mounting height of accessories as indicated on drawings.

B. Keyed Units: Key all similar types of units alike. Provide two keys per unit.

PART 3 EXECUTION

3.01 INSPECTION

A. Installer: Examine substrates, previously installed inserts anchorages necessary for mounting of accessories and other conditions under which installation is to occur.

1. Notify Contractor in writing of conditions detrimental to proper and time completion of the work.
2. Do not proceed with work until satisfactory conditions have been corrected.

3.02 INSTALLATION

A. Install in accordance with manufacturer's instructions using fasteners which are appropriate for substrate and recommended by manufacturer of unit. Install units and plumb and level, firmly anchored in positions indicated.

B. Provide concealed fasteners wherever possible of types required for substrate conditions encountered.

1. Metal Stud and Gypsum Board: Screws or bolts anchored to 16 gage (minimum) metal plate blocking or wood blocking located within stud space

C. Lead, plastic or fiber plugs are not acceptable.

D. Grab Bars: Coordinate grab bar locations as to right hand or left hand installations with field conditions.

1. Install to withstand a downward load of at least 250 lbf, when tested according to ASTM F446.

E. Upon completion of installation, adjust each accessory unit for proper operation and clean exposed surfaces. Turn over keys to designated Owner's personnel.

END OF SECTION

SECTION 10 44 00

FIRE EXTINGUISHERS AND CABINETS

PART 1 GENERAL

1.01 WORK INCLUDED

A. Provide fire extinguishers and cabinets as shown and specified.

1. Provide fire extinguishers with wall brackets in non-finished areas (i.e. mechanical rooms, electrical rooms, etc.).

1.02 RELATED SECTIONS

A. Masonry (coordination for recessed cabinets): Section 04 00 00

1.03 QUALITY ASSURANCE

A. Provide fire extinguishers complying with Fire Protection Association (NFPA) Pamphlet No. 10.

B. Provide only new portable fire extinguishers fully loaded, tested and approved by Underwriter's Laboratories (UL), and ready for use.

C. Fire-Rated, Cabinets: Listed and labeled to comply with requirements in ASTM E814 for fire-resistance rating of walls where they are installed.

1.04 SUBMITTALS

A. Product Data: For each type of product indicated. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for fire protection cabinets.

1. Cabinets: Include roughing-in dimensions, details showing mounting methods, relationships of box and trim to surrounding construction, door hardware, cabinet type, trim style, and panel style.

B. Samples: Submit 6” x 6” sample for each type of exposed finish required.

1.05 COORDINATION

A. Coordinate size of fire protection cabinets to ensure that type and capacity of fire extinguishers indicated are accommodated.

B. Coordinate sizes and locations of recessed fire protection cabinets with wall depths.

1. Coordinate location of fire extinguisher cabinets prior to construction of concrete masonry walls. Verify recessed type installations and coordinate these locations with the masonry construction.
   a. Provide mason with rough opening size of cabinets.

PART 2 PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. Portable Fire Extinguishers

1. J. L. INDUSTRIES
5. LARSEN'S MANUFACTURING COMPANY
6. POTTER-ROEMER
7. WATROUS

B. Fire Extinguisher Cabinets

1. J.L. INDUSTRIES
2. LARSEN'S MANUFACTURING COMPANY
3. POTTER-ROEMER
4. WATROUS

B. Where a specific manufacturer's product is specified herein it is to establish a level of quality. Products by the other manufacturers listed are acceptable providing they meet these specifications.

2.02 FIRE EXTINGUISHERS

A. Multipurpose Dry-Chemical Type: Fabricate in accordance with NFPA No.10, 10A, and 10L and UL Standards, except hose, gauge face cover, and horn cone parts shall be metal. No plastic or nylon valves, trigger/handle, casing, or gauge will be acceptable. Fire extinguishers, unless indicated otherwise, shall be 10 lb. multi-purpose dry chemical type for use on A, B, and C fires (4A-60BC), with hose and horn.

1. Provide this type throughout facility, unless noted otherwise.

B. Size: 21-1/2" high x 8-1/2" wide x 5" deep.

2.03 FIRE EXTINGUISHER CABINETS

A. Provide steel construction

B. Basis of Design: Drawings and specifications are based on LARSEN Architectural Line with full glass door. LARSEN catalog numbers are listed to establish a standard of quality and mounting type. ~~Equal~~ products may be provided from the listed acceptable manufacturers. Provide the following wall mounting types where a specific type of cabinet is indicated on the drawings. <u>Where no type is indicated, provide semi recessed units.</u>

1. Recessed - Steel: 2409-R, Flat Trim.
2. Surface Mount - Steel: 2409-SM.
3. Semi-Recessed - Steel: 2409-6R.
4. Doors: Full glass

C. Coordinate final model size with fire extinguisher.

D. Finish

1. Steel: Baked enamel or powder-coat.

E. Mounting Brackets: Provide manufacturer's standard plated finish, heavy duty mounting brackets for surface mounted fire extinguishers. Provide proper size and type for capacity of extinguishers indicated.

F. Fire Rated Cabinets: Listed and labeled to meet requirements of ASTM E814 for fire resistance rating of wall where it is installed.

1. Construct fire rated cabinets with double walls fabricated from 0.0478 inch thick, cold rolled steel sheet lined with minimum 5/8 inch thick, fire barrier material.

G. Identification: Lettering complying with authorities having jurisdiction for letter style, size, spacing, and location. Locate the words "FIRE EXTINGUISHER" vertically on cabinet door.

1. Identify bracket-mounted fire extinguishers with the words "FIRE EXTINGUISHER" in red letter decals applied to mounting surface.

2.04 CABINET FABRICATION

A. Provide standard steel box with trim, frame, door and hardware to suit cabinet type, trim style and door indicated. Weld all joints and grind smooth; miter and weld door frames. Fabricate trim in one piece with corners mitered, welded and ground smooth. Open miters are not acceptable.

PART 3 EXECUTION

3.01 EXAMINATION

A. Examine walls and partitions for suitable framing depth and blocking where recessed and semirecessed cabinets will be installed.

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

3.02 PREPARATION

A. Prepare recesses for recessed and semirecessed fire protection cabinets as

required by type and size of cabinet and trim style.

3.02 INSTALLATION

A. Install fire extinguishers and fire extinguisher cabinets where indicated or as directed by Architect in accordance with manufacturer's instructions and recommendations. Mount at heights indicated, when not indicated as directed by Architect.

B. Securely anchor brackets and cabinets to substrate construction with toggle bolts or expansion anchors. Lead, wood or plastic plugs and fasteners are not acceptable.

C. Fire extinguishers are to be fully charged and ready for use when building is turned over to the Owner. Extinguishers shall be certified as fully charged by an approved fire extinguisher service company and shall be tagged or labeled as such.

3.03 ADJUSTING, CLEANING, AND PROTECTION

A. Adjust cabinet doors that do not swing or operate freely.

B. On completion of installation, clean interior and exterior surfaces as recommended by manufacturer.

C. Touch up marred finishes, or replace fire protection cabinets that cannot be restored to factory-finished appearance. Use only materials and procedures recommended or furnished by fire protection cabinet and mounting bracket manufacturers.

D. Replace fire protection cabinets that have been damaged or have deteriorated beyond successful repair by finish touchup or similar minor repair procedures.

E. Provide final protection and maintain conditions that ensure that cabinets and doors are without damage or deterioration at the time of Substantial Completion.

END OF SECTION

SECTION 12 33 55

MANUFACTURED PLASTIC LAMINATE CLAD CASEWORK

PART 1 GENERAL

1.01 WORK INCLUDED

A. Provide plastic laminate casework as indicated on drawings. Countertops and custom pieces are specified under Section 06 40 00.

B. Accessories common to casework are included as work of this section.

1.02 RELATED SECTIONS

A. Wood Blocking: Section 06 10 50.

B. Countertops: Section 06 40 00.

C. Custom Casework: Section 06 40 00.

D. Vinyl Base: Section 09 65 13.

E. Sustainable Design Requirements: Section 01 81 13.

F. VOC Limits: Section 01 81 16

1.03 QUALITY ASSURANCE

A. Fabricator qualifications: A firm specializing in the fabrication of millwork with a satisfactory record of performance on projects of comparable size and quality. Fabricator manufacturing, materials and installations shall adhere to applicable AWI Quality Standards Illustrated and be acceptable to the Architect.

B. Installation: Performed only by experienced skilled finish carpenters.

C. Catalog Standards

1. Manufacturer's catalog numbers, where shown, are for convenience in identifying cabinet work.
2. Use of a specific manufacturer's catalog numbers is not to preclude the use of any other acceptable manufacturer's product or procedures that may be equivalent.

D. Reference Standards: Wherever the following abbreviations are used herein, they shall refer to the corresponding standard:

1. ANSI: American National Standards Institute.

2. AWI: Architectural Woodwork Institute.
3. NEMA: National Electrical Manufacturer's Association.
4. ASTM: American Society for Testing and Materials.
5. CS: Commercial Standard.

E. Quality Grade: Materials and fabrication shall be "custom grade" in accordance with "Quality Standard Illustrated," of the AWI conforming to the following sections:

1. Section 200: Plywood and particleboard.
2. Section 400: Casework.
3. Section 1700: Installation

1.04 DEFINITIONS

A. Exposed Portions of Casework: Include surfaces visible when doors and drawers are closed. Bottoms of casework more than 4 feet above floor and tops less than 6 feet 6 inches above floor shall be considered as exposed. Visible members in open cases or behind glass doors also shall be considered as exposed portions.

B. Semi-Exposed Portions of Casework: Includes those members behind opaque doors, such as shelves, divisions, interior faces of ends, case back, drawer sides, backs and bottoms, and back face of doors. Tops of casework 6 feet 6 inches or more above floor shall be considered semi-exposed.

C. Concealed Portions of Casework: Include sleepers, web frames, dust panels, and other surfaces not usually visible after installation.

1.05 SUBMITTALS

A. Product Data: Submit manufacturer's/fabricator's data and installation instructions for each type of casework unit.

B. Samples: Submit samples of specified finishes.

C. Shop Drawings

1. Submit shop drawings for casework showing plans, elevations, ends and cross sections.
2. Show details and location of anchorages and fitting to floors, walls and base.
3. Include layout of units with relation to surrounding walls, doors, windows and other building components.

D. Sustainable Design Documentation Submittals: Comply with Section 01 81 13.

1. VOC Limits: Include documentation verifying product Low Emitting Material Building Product Disclosures and Optimization.

1.06 DELIVERY, STORAGE AND HANDLING

A. Protect casework during delivery, storage and handling to prevent damage, soiling and deterioration.

B. Do not deliver casework until concrete, masonry and other similar wet work has been completed and is thoroughly dry, outside door openings are permanently watertight, exterior windows are glazed and, in case of temperature dropping below 60° F., until temporary heating and ventilating systems are in operation.

C. Store casework in dry, well-ventilated spaces with constant minimum temperature of 60° F., and maximum relative humidity of 55%.

1.07 PROJECT CONDITIONS

A. Do not deliver or install plastic laminate product until the following conditions are met:

1. Windows and doors are installed and the building is secure and weather tight.
2. Ceiling, overhead ductwork and lighting are installed.
3. All painting is completed and floor tile is installed.
4. Interior building temperature to be between 60° and 80° F, and ambient relative humidity maintained between 25% and 55% prior to delivery, and during and after installation.

B. Obtain measurements and verify dimensions and details before proceeding with finish carpentry.

1.08 WARRANTY

A. Plastic laminate faced casework to be guaranteed by manufacturer, and Contractor jointly and severally to the Owner for five years, to be free of defects due to faulty materials, workmanship, or performance.

B. Warranty not to include damage sustained as a result of abuse, negligence, use beyond that of it's intended function by the Owner, acts of God, or unnatural events or causes beyond the control of the manufacturer.

C. Include repair and replacement of defective materials and components at no additional cost to the Owner.

PART 2 PRODUCTS

2.01 MATERIALS

A. Particle Board (Substrate for Laminate Surfaces): High density industrial grade with a minimum density of 45 pounds per cubic foot and a moisture content between 9% maximum and 6% minimum, meeting or exceeding ANSI A208.1 Grade M-3 or ASTM D1037.

B. Fiberboard: Uniform, medium density conforming to ANSI A208.2. Maximum

moisture content of 8%. Meet the following minimum standards:

1. Internal Bond: 125 psi.
2. Modulus of Rupture: 4,000 psi.
3. Modulus of Elasticity: 400,000 psi.
4. Screw Holding Power: 325 pounds.
5. Density: Minimum 50 pounds per cubic foot.

C. Hardboard: Tempered, smooth both sides; conforming to ANSI/AHA A135.4 Class 1.

D. Lumber: Optional framing material for concealed framing. Conform to AWI requirements premium grade; provide in suitable species of manufacturer's option.

E. Plastic Laminate: Conform to the requirements of the National Electrical Manufacturer's Association (NEMA) Publication Number LD-3. Colors, patterns and finishes as indicated.

1. General Purpose Horizontal Grade: 0.05 inches thick.
2. General Purpose Vertical Grade: 0.028 inches thick.
3. Backing Sheet Grade: 0.02 inches thick.
4. Post-Forming Grade: 0.042 inches thick.
5. Cabinet Liner: 0.02 inches thick.
6. Fill and seal plastic laminate joints with Seamfil by KAMPEL ENTERPRISES, INC. or FormFill by FORMFILL PRODUCTS (UNIKA USA). Colors specifically mixed by manufacturer to match plastic laminate.
7. Manufacturer and Color: As indicated
8. Other Acceptable Manufacturers: Solid surface manufactured by the following companies are acceptable providing they meet the requirements specified herein and the colors and pattern are an acceptable match as determined by the Architect.
   a. FORMICA
   b. PIONITE
   c. NEVAMAR

F. Edging Materials

1. 1mm PVC banding, machine applied.
2. 3mm PVC banding, machine applied and machine profiled to 3 mm radius.
3. Colors: As selected by Architect.

G. Pressure Fused Laminate/Interior Surfacing

1. Melamine resin impregnated, 100 gram PSM minimum, surface laminated to core under pressure.
2. Meet NEMA LD3.1-1991 GP28 standards and NEMA LD3-1991 CL20 standards.

3. White pressure fused laminate for cabinet interiors behind door and drawers, interiors of all open cabinets unless otherwise specified, and underside of wall cabinet unless otherwise specified.
4. Shall be balanced at all concealed surfaces with phenolic backer. Unsurfaced coreboard not allowed.

H. Hardware Items: All exposed hardware to be (polished brass) (satin stainless steel) (polished stainless steel) finish.

1. Drawer Slides: Self-closing, side mounting type with nylon tire, steel ball-bearing rollers. Manufactured by BLUM, GRASS, AMEROCK, KNAPE & VOGT; ACCURIDE. Load capacity as follows:
   a. 75 pounds: Drawers up to 3-1/2 inches deep: Similar to ACCURIDE Series 2132.
   b. 100 pounds: Drawers up to 8 inches deep: Similar to ACCURIDE Series 2832.
   c. 150 pounds: Drawers over 8 inches deep, all file drawers: Similar to ACCURIDE Series 4034.
2. Drawer and Door locks: 5-pin tumbler removable core, dead bolt. BEST; COMPX NATIONAL; CORBIN. Key and masterkey locks as directed by Associate Architect. Provide 2 keys per cylinder and 5 masterkeys per master set.
3. Hinges: 5-knuckle hinges complying with BHMA A156.9, Grade 1, with antifriction bearings and rounded tips. Provide 2 for doors 42 inches high or less and 3 for doors more than 42 inches high
4. Drawer and Door Pulls: Indicated on the drawings. Catalog numbers based on EPCO; **products by GRASS, BLUM, HAFELE are acceptable.**
5. Adjustable Cabinet Shelf Supports: Provide metal pilaster type or hardwood drilled type, manufacturer's standard.
   a. Metal Type: KNAPE & VOGT (KV) steel nickel plated.
      1) Standards: KV #255 NP for dado installation.
      2) Clips: KV #256 NP.
6. Adjustable Cabinet Shelf Supports: 5mm spoon type; nickel plated.
7. Catches: Magnetic, STANLEY #45 or **products** by NATIONAL LOCK or EPCO.

I. Glue: Waterproof adhesive (phenol, resorcinol or melamine) base meeting requirements of CS 253 for "Wet Use" unless otherwise specified in specific sections.

J. Plywood: Birch hardwood plywood conforming to AWI Section 200 for veneer core material, AWI "custom" grade, provide with waterproof glue.

2.03 FABRICATION - CASEWORK

A. General: Except as specified hereinafter, fabricate all work in accordance with AWI quality standards as specified. Work not specified with a level of quality shall be not less than "Custom" quality per AWI.

1. "Flush Overlay" design as shown in AWI Architectural Casework Details.

2. Provide complete factory-fabricated and finished components which, when assembled on site, will provide an integral system of storage and work surfaces.
3. Provide locks where indicated.
4. Make cut-outs and other provisions for the work of other trades and as indicated or required for installation.
5. Assemble cabinets with accurate router grooves 1/8" deep with glue and nails and screws.
6. Apply plastic laminate to exposed ends after assembly to conceal screws in end cabinet.
7. All particle board panels to be balanced construction.

B. Subbases: Provide continuous plywood closed bases capable of being leveled to meet site conditions; subbase to be unfinished to receive resilient base. See Section 09 65 00.

C. Base Cabinets

1. Sides and Bottoms: Construct of 3/4" thick particle board with interior of cabinet finished with cabinet liner or polyester laminate. Provide balanced constructed panels with neutral colored backer sheet at concealed conditions and finish laminate at exposed conditions.
2. Backs: Standard 1/4" prefinished hardboard. Install in housed joints in surrounding panels. All backs exposed to view to be neutral colored except where indicated to match vertical color surfaces.
   Rear, unexposed side of backs to receive continuous hot melt glue at joint between back and sides/top/bottom for sealing against moisture and vermin, and to further contribute to cabinet stability.
3. Frame: Provide frame construction of 3/4" thick particle board or lumber dadoed into sides at the following:
   a. As sub-top.
   b. At all locked drawers and doors.
4. Runners: Provide runners or frame construction between all drawers.
5. Shelves: Provide fixed and adjustable shelves with particle board core where indicated on drawings. Provide shelves adjustable on 1/2" centers. Except for exposed shelving conditions, finish shelves with neutral colored polyester laminate or liner grade laminate
   a. Shelves under 36" wide: 3/4" thick, except all open shelves to be 1" thick.
   b. Shelves 36" to 42" wide: 1" thick.
   c. Shelves over 42" wide: Construct in accordance with AWI Section 400 to support minimum 30 lbs./running foot of shelf with deflection limited to 1/4" or provide intermediate supports to limit the span to ranges specified above.
   d. Edges: Except where cabinet design requires matching laminate self edge, provide 3mm PVC on Front & Back Edges, 1mm PVC on Side Edges.
6. Finish
   a. Casework Edges: Except where cabinet design requires matching laminate edges, finish front edges of sides, frames, and bottom

with 3mm PVC machine applied edge.

b. Exposed Exterior of Casework: Finish exposed portion of cabinet with vertical grade plastic laminate in solid color finish as selected by Architect.

c. Interior of Casework

1) Semi-Concealed (behind doors): Neutral colored polyester or cabinet liner laminate.

2) Exposed: Vertical grade laminate to match exposed casework.

D. Drawers

1. Body: Construct of fiberboard with polyester laminate finish on faces and PVC on exposed top edges. Subfronts, sides and back fabricated with shouldered lock joint or dado construction and routed to receive bottom.
   a. Sides and Back: 1/2" thick.
   b. Subfront: 5/8" thick.
2. Bottom: 1/4" thick prefinished hardboard, housed and glued, into front, sides and back. Underside of drawer to receive continuous hot melt glue at joint between bottom and back/sides/front for sealing and rigidity. Reinforce drawer bottoms as required with intermediate spreaders.
3. Front: 3/4" thick particle board front finished with vertical grade plastic laminate on exposed face and cabinet liner laminate on interior side; total thickness 13/16" thick. Except where cabinet design requires self edge matching laminate edges (see cabinet design), edges to be finished with 1mm PVC.
   a. Where adjacent door sizes require core thickness in excess of 3/4", provide drawer fronts to match door thickness. Verify conditions with Architect.
4. Install on proper sized slides specified herein.

E. Doors: Construct and finish same as drawer fronts except core construction to vary as follows:

1. Doors over 30" x 48": Construct from 1" to 1-1/4" thick particle board core.
2. Doors over 36" x 60": Construct as 1-3/8" thick hollow core units in accordance with AWI Section 1300.

F. Wall Cabinets: Construct and finish same as base cabinets except provide suitable hang rail of 3/4" plywood secured to cabinet frame.

1. Where wall cabinets close to soffit or ceiling, provide fascia scribed to conditions and leveled on bottom to permit level installation of cabinets. Finish of fascia to match cabinet.

G. Design

1. Configuration of casework is indicated on drawings.
2. The detailing and design required to provide rigid, solid and structurally adequate casework is the responsibility of the fabricator; within parameters

of AWI specifications and as approved by Architect.

3. The following conditions require special attention:
   a. Casework exceeding 42" in width between supports.
   b. Sink and/or equipment cutouts and supports.
   c. Countertops exceeding 24" unsupported.
   d. Wall and Ceiling Mounted Casework: Provide integral framing in casework of size, strength, and in locations which allow unit to be screw attached to proper substrate and remain rigidly in place.

PART 3 EXECUTION

3.01 EXAMINATION

A. Examine areas, with Installer present, for compliance with requirements for installation tolerances, location of reinforcements, and other conditions affecting performance of laboratory casework.

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

302 PREPARATION

A. Condition casework to average prevailing humidity conditions in installation areas prior to installing.

3.03 CASEWORK INSTALLATION

A. General

1. Install plumb, level, true and straight with no distortions so that doors and drawers will fit openings properly and be accurately aligned.
2. Shim as required using concealed shims.
3. Where casework abuts other finished work, scribe and apply filler strips for accurate fit with concealed fasteners.
4. Where possible, assemble units into one integral unit with joints flush, tight and uniform. Align similar adjoining doors and drawers to a tolerance of 1/16".
5. Anchor cabinet units securely in place with concealed (when doors and drawers are closed) fasteners, anchored into structural support members of wall construction. Comply with manufacturer's instructions and recommendations for support of unit.
6. Adjust casework and hardware so that doors and drawers are centered in openings and operate smoothly without warp or bind. Lubricate operating hardware as recommended by manufacturer.

B. Base Cabinets

1. Fasten each individual cabinet to floor at toe space, with fasteners spaced at 24" on center.
2. Bolt continuous cabinets together.

3. Secure individual cabinets with not less than 2 fasteners into floor, where they do not adjoin other cabinets.

C. Wall Cabinets

1. Verify that wood blocking has been installed at required locations.
2. Bolt continuous cabinets together.
3. Secure individual cabinets with not less than 2 fasteners into wall (wood blocking), where they do not adjoin other cabinets.

3.02 CLEANING AND PROTECTION

A. Repair or remove and replace defective work as directed upon completion of installation.

1. Patch surfaces damaged by installation to prior condition as approved or replace damaged units as directed.

B. Clean shop-finished surfaces, touch-up as required, and remove or refinish damaged or soiled areas, as acceptable to Architect.

1. Dust cabinet interiors. Clean exterior surfaces to original condition.

C. Advise Contractor of procedures and precautions for protection of materials and installed casework from damage by work of other trades.

END OF SECTION

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DIVISION 27 – COMMUNICATIONS

DIVISION 28 - ELECTRONIC SAFETY AND SECURITY

SECTION 27 00 01

GENERAL REQUIREMENTS FOR COMMUNICATIONS

PART 1 - GENERAL

1.1 DEFINITIONS

A. Acceptance Testing Authorities (ATA) - The individuals and/or business entities that participate in Acceptance Testing and report to the Owner when work appears to be compete. These parties represent the interest of the Owner.

B. Authority Having Jurisdiction (AHJ) - The governmental agency or sub-agency having authority over the construction process and having the ultimate authority to enforce, uphold and rule on codes and safety compliance at the project site.

C. Contractor – The entity(s) contractually responsible for performing work of this Division.

D. Wherever the words “Site”, “Project Site”, or “Premises” appears in these specifications or related drawings, it shall be interpreted to mean all real estate, buildings and structures where work will be performed and where products will be installed and reside.

E. Commissioning Authority – An agent of the Owner, often independent of the design team, responsible for ensuring compliance with the Owner’s project intent.

F. Contractor of Record – The Contractor entering into a contract for all or part of the work of this division directly with the Owner, directly with the Construction Manager or directly with a General Contractor.

G. Designer – The Consultant(s) representing the Owner and directly responsible for specification of work within this Division including their related drawings. The Designer may or may not be affiliated with the architectural or an engineering firm of record for this Project. The Designer is a member of the project Design Team.

H. Furnish – To supply product or labor (context dependant) including all associated shipping, storage, travel, lodging, miscellaneous and warranty expenses.

I. High Voltage – For the sake of this division, greater than 70.7VAC RMS; greater than or equal to 100VAC P-P; greater than 70.7VDC

J. Install – To supply all labor, tools and incidental materials necessary to handle, store, mount, terminate, program, configure and adjust a product in order to fulfill the requirements of this project.

K. Low Voltage – For the sake of this division, less than or equal to 70.7VAC RMS; less than 100VAC P-P; less than or equal to 70.7VDC

L. Medium Voltage – For the sake of this division, greater than 70.7VAC RMS; greater than or equal to 100VAC P-P; greater than 70.7VDC.

M. Nominal Operating Level: The standard signal voltage/power reference which a manufacturer has designed its product's inputs and outputs to operate at in order to achieve specified performance.

N. Provide – To furnish and install, inclusive of accessories, modules, and ancillary items necessary to render the respective product and system fully operational and usable to the Owner for its intended purpose.

O. Substantial Completion
   1. The point in this project where all work of this Division that occurs at the project site has been completed. For work to be substantially complete, all of the following must be valid:
      a. All products have been delivered and installed at the project site, and;
      b. All portable and loose equipment has been delivered, and;
      c. All systems have been installed, adjusted and are usable by the owner for their intended purpose, and;
      d. All products, including cables, have been labeled in accordance with these specifications and related drawings, and;
      e. All systems are performing in accordance the design intent of these specifications, drawings and reference standards, and;
      f. All systems have been demonstrated as complete and working to the
      g. Designer, and;
      h. All systems have been demonstrated as complete and working to Owner, and;
      i. The Contractor has successfully completed Acceptance Testing of all work of all sections.
      j. The Contractor has complied with all additional requirements of the
      k. Contract.

P. Work – The supply of products, materials, labor, incidentals and services necessary to fulfill the complete requirements of this project.

Q. Acronyms and Abbreviations
   1. ADA - Americans with Disabilities Act
   2. AM – Amplitude Modulation
   3. ANSI – American National Standards Institute
   4. ASME - American Society of Mechanical Engineers
   5. ASTM – American Society of Testing Materials
   6. ATM – Asynchronous Transfer Mode
   7. AWG – American Wire Gauge
   8. BGP – Border (Boundary) Gateway Protocol
   9. BICSI - Building Industry Consulting Services International
   10. BIT – Binary digit
   11. BOM – Bill of Material
   12. Bps – Bits per second
   13. BRI – Basic Rate Interface
   14. CAD – Computer Aided Design
   15. CAN – Campus Area Network

16. CATV – Community Antenna Television
17. CCITT – Consultative Committee for International Telegraphy and Telephony
18. CCTV – Closed Circuit Television
19. CDDI – Copper Distributed Data Interface
20. CLEC – Competitive Local Exchange Carrier
21. CPE – Customer Premises Equipment
22. CPU – Central Processing Unit
23. CSA – Canadian Standards Associations
24. CSMA/CA – Carrier-Sense Multiple Access with Collision Avoidance
25. CSMA/CD – Carrier-Sense Multiple Access/Collision Detection
26. CSU – Channel Service Unit
27. db - Decibel
28. Device ID – A system specific label assigned to a product to uniquely identify it within a given a system.
29. DSL – Digital Subscriber Line
30. DSU – Data Service Unit/Digital Service Unit
31. DTE – Data Terminal Equipment
32. EF – Entrance Facility
33. EGP – Exterior Gateway Protocol
34. EIA – Electronics Industries Association
35. EMI – Electromagnetic Interface
36. ER – Equipment Room
37. ETSI – European Telecommunications Standards Institute
38. FCC – Federal Communications Commission
39. FDDI – Fiber Data Distributed Interface
40. GAN – Global Area Network
41. GB – Giga Byte
42. Gb/s (Gbps) – Gigabits per second
43. GHz – Gigahertz
44. IDF – Intermediate Distribution Frame (Replaced by TR)
45. IEEE – Institute of Electrical and Electronics Engineers
46. IP – Internet Protocol
47. IPX – Internet Packet Exchange
48. ISDN – Integrated Services Digital Network
49. ISO – International Organization for Standardization
50. ISP – Internet Service Provider
51. LAN – Local Area Network
52. LANE – LAN Emulation
53. LASER – Light Amplification by Stimulated Emission of Radiation
54. LAT – Local Area Transport
55. LATA – Local Access and Transport Area
56. LEC – Local Exchange Carrier
57. LED – Light Emitting Diode
58. MAC – Media Access Control
59. MAN – Metropolitan Area Network
60. MB – Mega Bytes
61. Mb/s (Mbps) – Megabits per second
62. MDF – Main Distribution Frame (Replace by ER)
63. MHz – Megahertz
64. MODEM – Modulator/Demodulator
65. ms – millisecond

66. MTBF – Mean Time Between Failures
67. MPLS – Multi Protocol Label Switching
68. OC – Optical Carrier
69. OFCI – Owner Furnished Contractor Installed
70. OFE – Owner Furnished Equipment
71. OFOI – Owner Furnished Owner Installed
72. OSI – Open Systems Interconnection
73. PAN – Personal Area Network
74. pps – Packets Per Second
75. PRI – Primary Rate Interface
76. PSTN – Public Switched Telephone Network
77. QoS – Quality of Service
78. RAID – Random Array of Inexpensive Disks
79. RAM – Random Access Memory
80. RBOC – Regional Bell Operating Company
81. RF – Radio Frequency
82. RFC – Request For Comment
83. RFI – Request For Information/ Radio Frequency Interference
84. RFP – Request For Proposal
85. RFQ – Request For Quotation
86. RIP – Routing Information Protocol
87. RMON – Remote Monitor
88. ROM – Read Only Memory
89. SMTP – Simple Main Transfer Protocol
90. SNA – Systems Network Architecture
91. SNMP – Simple Network Management Protocol
92. SONET – Synchronous Optical Network
93. TB – Tera Byte
94. TCP – Transmission Control Protocol
95. TCP/IP – Transmission Control Protocol/Internet Protocol
96. TIA – Telecommunications Industries Association
97. TR – Telecommunications Room
98. VoIP – Voice over Internet Protocol
99. WAN – Wide Area Network

1.2 QUALITY ASSURANCE

A. The Contractor shall have a business history of at least (5) years performing Work of similar type as that specified in these project documents. In addition, the Contractor shall also be able to demonstrate through valid references and other Designer required support information that it has successfully completed no less then (6) projects of similar or greater contract value, with like system types, and including similar scope of work within the last 24 calendar months. This applies to each section of work individually.

B. Contractor shall be a “factory-authorized” reseller (distributor, dealer, integration partner and/or channel partner) for at least 70% of the product value to be supplied.

C. Contractor shall have substantial business operations located within a (300)-mile radius of the project site with full-time employee staff actively engaged in the supply,

installation and service of systems and equipment of the type and scope herein specified.

D. Contractor shall have full-time employee service staff based within a (50)-mile radius of the project site.

E. Contractor shall supply any additional information requested by the Designer deemed appropriate by the Designer to validate the Contractor's qualifications and its ability to perform and warranty the specified work within the time frame allotted and of the quality expected.

F. Contractor shall provide the services of locally licensed and authorized electrician(s) to perform that portion of the work of this division that is required by the applicable codes and/or the AHJ to be performed by licensed electrician(s).

G. Superintendent/Project Manager
   1. The Contractor shall furnish the services of an experienced superintendent/Project Manager who shall be constantly in charge of the work, together with a qualified Foreman and technical specialists to properly install, connect, adjust, start, operate and test the work involved.
   2. The superintendent's/Project Manager's qualifications shall be subject to the review and acceptance by the Designer and Owner. Unless the Designer and Owner grants prior special permission, the same Superintendent/Project Manager shall be utilized throughout the duration of the project and shall remain responsible for the complete scope of the Contract.

H. Subcontractors
   1. If the Contractor, as a singular entity, does not meet 100% of the quality assurance requirements for all specification sections, the Contractor shall enlist the services of qualified subcontractors to perform the work of those section(s) for which Contractor is not fully qualified. This includes but is not limited to the supply of the products for the section but also the supply of the project engineering services, preparation of shop drawings and section submittals, technical installation labor, training, warranty, post installation support and service.
   2. The Contractor shall ensure that each Subcontractor supplies the services of a project manager to represent the interest of the Subcontractor at all project meetings in which the Contractor is also required to participate. This requirement is mandatory as an aid towards ensuring that the special needs and timing of subcontracted work are fully represented to the project team.
   3. The Designer and Owner reserve the right to disqualify the use of any subcontractor that does not meet the quality assurance requirements set forth in these specifications. Should a subcontractor be disqualified, the Contractor shall supply the services of a different subcontractor that complies with the published quality assurance requirements. The Contractor is solely responsible for costs incurred as a result. It is therefore incumbent upon the Contractor to pre-qualify subcontractor choice(s) prior to submitting pricing for work.
   4. For the purposes of achieving quality assurance compliance, an equipment vendor that is not performing the technical installation labor associated with work of a section shall not be considered a subcontractor

I. Trainer Qualifications
   1. Individual(s) conducting training shall be fully knowledgeable of the product, system and technology on which they will be training. These individuals shall be factory trained, factory certified and/or otherwise approved by the Designer as having sufficient experience and knowledge in the area of interest to conduct training.

1.3 SUBMITTALS

A. Refer to Section 26 00 15 “Submittals”.

1.4 WARRANTY

A. Unless otherwise noted, all materials and workmanship furnished shall be covered by the Contractor for a minimum period of (1) year from date of Acceptance Testing Completion or Substantial Completion (whichever is later) for related work.
   1. Supplied products with manufacturer’s warranties of less than the warranty term shall be extended by the Contractor for the full specified warranty term.
   2. Supplied products featuring a standard manufacturer’s warranty whose term extends beyond the Contract Warranty term shall be shall be facilitated by the Contractor for the full duration and conditions of the manufacturer’s warranty.

B. The Warranty supplied shall be a full “System Warranty” that covers all supplied products, onsite and off-site labor and related personnel transportation and product shipping expenses.
   1. During this period the Contractor will remedy (at no cost to the Owner) any problem with the system, or any of its related components that is the result of defective materials, equipment settings, workmanship, or loss of programming.

C. Individual sections of this Division may feature more stringent requirements than those set forth in this section. The most stringent of these requirements shall apply.

D. All warranty work shall be performed at the Contractor’s expense and to the satisfaction of the Owner and Designer.

E. Response Requirements
   1. During the Warranty Period, the Contractor shall:
      a. Respond by phone within four (4) business hours of notice by the Owner of a problem, and;
      b. Supply qualified personnel onsite within (1) business day or (72) contiguous hours (which ever comes first) to begin remediation of the problem, if the problem cannot be remediated over the phone in less time, and;
      c. Supply “on-call” emergency response service labor (at the request and authorization of the Owner) at a hourly rate that does not exceed the Contractor’s published emergency service rates, nor two-times the Contractor’s standard hourly rate, whichever is lower.

PART 2 - PRODUCTS

2.1 GENERAL

A. Materials, apparatus and equipment shall bear the Underwriter's Laboratory, Inc. label (or other nationally recognized testing laboratory label) where regularly supplied, and as additionally required by Code.

B. All products furnished shall be new, full weight and of the best quality. All similar materials shall be of the same type and from the same manufacturer.

C. In the event that a specified product is discontinued by the manufacturer and is no longer available for purchase, the Contractor shall provide replacement product of equal or greater value, performance and function as that of the Basis of Design product. The replacement product shall be from the same manufacturer as that of the Basis of Design equipment unless written permission has been granted by the Designer. The Contractor is solely responsible for researching and submitting proposed replacement product. The final decision as to whether a Contractor proposed replacement is acceptable lies solely with the Designer

D. Substitute products will only be considered provided that the Contractor has strictly adhered to the guidelines set forth by Division 1 Specifications.

PART 3 - EXECUTION

3.1 WORK AND WORKMANSHIP

A. Provide all required labor, materials, equipment and Contractor’s services necessary for complete installation of systems required to comply with the requirements of authorities having jurisdiction, as indicated on Drawings, and as specified.

B. Work shall be functional and complete in every detail, including any and all items required to complete the system, regardless of whether all items have been fully enumerated or shown on the Drawings.

C. Special attention shall be given to access to working and controlling parts. Adjustable parts shall be within easy reach. Removable parts shall have space for removal.

D. Contractor and Subcontractors shall be fully knowledgeable of the details of all Work to be performed by other trades and shall take necessary steps to integrate and coordinate Work of This Division with that of other Divisions and other trades.

E. Wherever tables or schedules show quantities, they shall not be interpreted to represent the total contract quantity requirement, but instead a portion of the contract requirement. The Contractor shall be responsible for the higher quantity communicated by the drawings, within the specifications and on the schedules/tables. Seek clarification from the Designer should a discrepancy between them be found.

F. The Designer and Owner's Representative have the full power to condemn or reject any Work, materials or equipment not in accordance with these Specifications and Construction Drawings or the manufacturer's specifications or drawings reviewed by the Designer or Owner.

G. Work or equipment that is rejected shall be removed and replaced to the satisfaction of the Owner at the Contractor's expense. Work or equipment that is rejected shall be so stated in writing by the Owner or Designer.

H. Such decisions that the Owner or Designer may make with respect to questions concerning the quality, fitness of materials, equipment, and workmanship shall be binding upon the parties thereto.

I. Work shall fully comply with these specifications and related Drawings and all manufacturers recommended installation guidelines.

J. All Work shall be performed with the best practices of the trade for performance, functionality, safety, endurance, and aesthetics.

K. Coordinate ordering and installation of all equipment with long lead times or having a major impact on work by other trades so as not to delay the job or impact the schedule.

L. Where mounting heights are not detailed or dimensioned, install systems, materials and equipment to provide the maximum headroom possible. Consult the Designer for direction.

M. Set all equipment to accurate line and grade, level all equipment and align all equipment components.

N. Supply scaffolding, rigging, hoisting and services necessary for erection and delivery of equipment and apparatus furnished into the premises. These items shall be removed from premises when no longer required.

O. Equipment shall not be hidden or covered up prior to inspection by the Owner's representative. Work that is determined unsatisfactory shall be corrected immediately.

P. Work shall be installed level and plumb, parallel and perpendicular to prevailing building lines, except as expressly detailed otherwise or required for proper form, function or Designer intended operation.

Q. Install equipment and materials in strict accordance with the manufacturer's written instructions. Bring conflicts between the manufacturer's written instructions and these project documents to the attention of the Designer for review and direction.

R. Upon completion of installation of equipment and communication circuitry, energize circuitry and demonstrate capability and compliance with requirements. Where possible, correct malfunctioning units at site, then retest to demonstrate compliance; otherwise, remove and replace with new units, and proceed with re-testing.

3.2 TESTING

A. General
   1. Upon complete physical installation of products, the Contractor shall align, balance, and adjust equipment to make it usable to the Owner for its intended purpose, and to ensure compliance with all related drawings, specifications and references.
   2. The Contractor shall fully test each system, and each component thereof, and correct all deficiencies prior to scheduling acceptance testing.
   3. Replace malfunctioning or damaged products with new product, following immediately with retesting until satisfactory performance and specification compliant conditions are achieved.

B. Operational Testing
   1. Perform operational testing of all supplied products, individually and collectively, to verify conformance with these project documents, and as required ensuring compliance with the product manufacturer's published specifications and as additionally necessary for the system to meet the intended purpose.
   2. Perform operational testing of Owner furnished equipment to the extent necessary to verify overall system functionality and specification compliance. Report any compliance problems that are directly the result of Owner Furnished Equipment.
   3. Although each system requires additional supplemental testing to confirm compliance, the following testing shall be conducted as they apply to the supplied systems products.
      a. Verify all functions of all supplied equipment as applicable to the design, functionality and intended use of the system.
      b. Test each system inputs and output.
      c. Test each remote control.
      d. Test each source device
      e. Setup and test portable equipment.

C. Performance Testing
   1. Perform all measurements and testing necessary to demonstrate performance compliance.

3.3 ACCEPTANCE TESTING

A. Acceptance Testing is conducted by the Designer and/or the Owner's designated Commissioning Authority and/or the Owner.

B. Acceptance testing occurs following the submittal and review of required Pre-Acceptance Submittal(s).

C. Acceptance testing may include, but may not necessarily be limited to:
   1. Visual and mechanical inspections of Contractor's workmanship
   2. Inventory of equipment
   3. Random system and/or component measurements to verify compliance with specifications and to check of the accuracy of the Pre-Acceptance Submittal and as-built drawings
   4. Inspection of system components, sub-systems, software, component functionality, etc…

5. Other tests and/or inspections as determined necessary by the Designer
6. Functional tests of system
7. Performance measurements of components or groups of components

D. The Contractor shall be onsite in advance of the scheduled acceptance testing time to get prepared for and stage for testing. Contractor shall schedule and coordinate acceptance testing with all parties. Contractor shall coordinate and ensuring free access into all areas of work.

E. The Contractor shall have qualified technical representation onsite to work with the Designer during Acceptance Testing. The representative(s) shall be fully familiar with aspects of the work being evaluated.

F. Prior to the start of Acceptance Testing the Contractor shall have turned over a copy of the most up-to-date as-built documentation.

G. The Contactor shall furnish and shall have present at the project site test equipment, cables, tools and personnel necessary to test, verify and demonstrate any product, operation, and workmanship deemed necessary by the Designer.

H. The Contractor shall be prepared to demonstrate the presence of supplied products, cabling and installation methods. The Contractor shall be prepared to demonstrate the operation of all systems (and each requested component thereof) and shall be prepared to make electronic, physical or software related adjustments to the system or any of its components to the satisfaction of the Designer.

I. Corrective actions may not be undertaken by the Contractor during Acceptance Testing that in any way impedes Acceptance Testing progress or negatively alters the day's schedule.

J. Acceptance Testing shall not pass if any of the following conditions are true.
1. Inspections do not substantially match the Pre-Acceptance Submittal.
2. Inspections do not match the criterion of these specifications.
3. The Contractor's workmanship does not appear to be of professional quality.
4. The Contractor has failed to follow established installation requirements.
5. As-built drawings have not been presented to the Designer prior to the commencement of Acceptance Testing.
6. As-built drawings are found to be incomplete or inaccurate.
7. More than one cable is found to be missing a required label.
8. More then one cable is found to be inaccurately recorded on the as-built drawings.
9. Installed equipment does not match the equipment specified and/or previously authorized for use by the Designer.
10. More then one unit of equipment, cable, connector, circuit, etc… fails to pass a test performed on it.
11. There are substantive workmanship issues judged by the Designer to be negative and are of material importance to the long-term usability, safety, professional appearance, or service and maintainability of the Contractor's work.
12. There is any material deviation from the intent of these specifications.

K. Contractor is entitled to no more then (2) acceptance testing visits per system. One primary visit and one follow-up (secondary) visit. The Contractor is responsible for reimbursement of Designer fees associated with each additional visit that is the result of the Contractor‘s failure to be complete; the Contractor’s failure to comply with the requirements of the contract documents; or the Contractor’s failure to be fully prepared for acceptance testing at the date and time scheduled. The cost for subsequent acceptance testing visits shall be $1500 per person, per day, plus travel and other expenses.
   1. An Acceptance Testing report (i.e. punch list) will be supplied by the Designer following each official Acceptance Testing visit enumerating issues found during the visit.

L. Should the Designer conclude that the Contractor has inaccurately represented the level of completion, the Designer reserves the right to abort the balance of the days’ scheduled acceptance testing and the Contractor shall be docked one acceptance testing visit for each system not evaluated.

3.4 TRAINING

A. Training shall be supplied for each section of this Division and for each unique system provided.

B. The Owner shall have the right to use total allocated training for a period of (365) calendar days following final completion of onsite work, solely at its discretion.

C. Training shall be supplied as expressly identified within individual sections. Where training requirements are not otherwise expressly identified, the Contractor shall supply a minimum of (2) hours per unique system, per section. The Contractor shall presume that at least (2) discrete trips to the project site shall be required per unique system to conduct training.

D. Training dates and times shall be coordinated with the Owner’s designated training representative(s).

E. Training shall cover the following:
   1. Normal system use and operation
   2. Procedures and schedules involved in troubleshooting and performing routine preventative maintenance.
   3. Other facets as identified in individual sections

F. Agenda and relevant training handouts shall be prepared and distributed to attendees at each training session.

G. A sign-in sheet shall be created and used for each training session. The sheet shall:
   1. The section and system(s) being trained upon.
   2. The date and starting time of the session.
   3. The signatures of all attendees.
   4. The ending time of the session, along with a separate owner signature certifying the ending time.
   5. Have attached to it a copy of the training outline/agenda.

H. Recording of Sessions
   1. When a related section requires recording of supplied training sessions they shall be recorded.
   2. Recordings shall be supplied on DVD video format media playable in standard consumer grade reproduction appliance. Recordings do not need to be professionally edited but shall feature intelligible audio and a clear image of the subject trainer and any supplemental visual content material to the training.
   3. Recordings shall be turned over and signed for by an Owner's training representative at the end of each session. A copy of a signed delivery receipt shall be included as part of the Contractor record documentation.
   4. Contractor shall require each attendee to sign-in at the start of each training session. The sign-in form shall summarize the training conducted, specification section and system being trained on, as well as the starting time and duration of training. Following training, a representative of the Owner shall sign the form, acknowledging the same. Contractor shall retain the original copy of these forms and turn over a photo copy of the form to the Owner's representative as evidence of training. Training conducted without this official record of training shall not be considered as part of the Contractor's training obligation.

I. In order for all training sessions to count towards the Contractor's training obligation, each of the following shall be met.
   1. Training occurs after Training Submittal review.
   2. Training session outlines/agenda are distributed at each session.
   3. Quality Assurance requirements for trainer have been met.
   4. Training occurs after the system / section is fully complete and working (usually following final Acceptance Testing). Training in advance of this requires Designer approval.
   5. Contractor fully complies with sign-in sheet requirements for every session.
   6. Contractor maintains a master training log.

END OF SECTION 27 00 01

SECTION 27 05 02

BASIC MATERIALS AND METHODS FOR COMMUNICATIONS

PART 1 - GENERAL

1.1 SUMMARY

A. All work performed shall be performed in accordance with all Codes applicable at the project site. The authority having jurisdiction shall have the final say as to whether code compliance has been achieved.

B. Wherever the contractor believes, or the authority having jurisdiction advises, that work required by these contract documents is in conflict with applicable codes, the Contractor shall immediately advise and seek the direction of the Designer.

1.2 TOOLS

A. Tools shall be used only for the purpose for which they are designed.

B. Specialty tools shall be used for assembly, installation, termination, and removal of products as recommended by the product manufacturer.

C. The designer reserves the right to require removal and replacement of any product installed using incorrect tools.

PART 2 - PRODUCTS - NOT USED

PART 3 - EXECUTION

3.1 COORDINATION

A. Coordinate installation of pathways before installation of pathways, including when pathways installation is not work of This Contractor.

B. Review pre-existing pathways prior to installation of work and report to the Designer any discrepancies between specified pre-existing pathway conditions and actual existing pathway conditions.

C. Coordinate with all other Contractors and the Owner, as applicable and necessary to ensure clean, professional looking and operating systems.

D. Participate in coordination efforts through the preparation of shop drawings and details prior to fabrication or installation of any products. Coordinate actual clearance requirements of installed products.

E. Begin coordinate immediately upon award of contract. Coordinate work with all other trades and adjust equipment locations accordingly. Refer to coordination drawings prepared by other trades; generate and supply the same for use by other trades.

F. It is generally intended that all apparatus be located symmetrical with architectural elements and shall be installed at the heights and locations shown on the drawings. If a device height or location is in question it shall be the responsibility of the Contractor to immediately seek clarification of the Designer.

G. The Contractor shall fully inform himself regarding all peculiarities and limitations of space available for installation of all work and materials furnished and installed under the contract. He shall exercise due and particular caution to determine that all parts of his work are made quickly and easily accessible. Although the locations of equipment and conduit may be shown on the drawings in certain positions, the architectural details and conditions existing at the job site shall guide the Contractor, coordinating his work with that of others. Provide all necessary offsets to provide a neat workmanlike arrangement.

H. Plans are generally diagrammatic and indicate the design intent, required sizes, points of termination and, in some cases, suggested routes of raceways, etc. However, it is not intended that plan drawings indicate fully coordinated routing and placement, all necessary offsets, etc…

I. Contractor shall refer to all drawings, including enlarged plans, elevations, sections, and details for additional information that may include dimensions and greater resolution and notes that serve to refine the intent and further assist and guide the Contractor.

J. The Contractor shall work in harmony with all other contractors and subcontractors performing work at the project site, so as not to cause any delays in pouring concrete, building masonry walls, etc. This Contractor shall consult ALL project drawings, including those predominately used by other trades before installing his work so as to ensure that his work will not interfere with or be adversely affected by work of other trades. This Contractor shall take all necessary steps to ensure a coordinated installation of his work.

K. This Contractor shall attend all regularly scheduled project meetings as well as any special meetings called to coordinate and/or resolve special issues that arise during the course of the project.

L. Conflicts in equipment and materials shall be corrected prior to installation. Should there be a conflict with drawings of other trades, this Contractor shall work with the trades to correct the conflict while coordinating the project (prior to installation). If the conflict cannot be resolved, refer the matter to the owner's representative for a final decision as to method or material. This Contractor shall refer to drawings of all other trades for details, dimensions and locations of other work and route their work so as not to conflict with any other branch. Any work installed or equipment placed in

position by this Contractor creating a conflict shall be readjusted to the satisfaction of the owner's representative at the expense of this Contractor.

3.2 INSTALLATION

A. General

1. Work installed in finished areas shall be concealed. Work installed in unfinished areas may be exposed at the discretion of the Owner's representative and approved in writing.
2. Sequence, coordinate, and integrate installations of communications materials and equipment with the work of other trades for efficient flow of the Work.
3. Install systems, materials, and equipment to conform with reviewed submittal data, including coordination drawings, to greatest extent possible.
4. Install systems, materials, and equipment level and plumb, parallel and perpendicular to other building systems and architectural/structural components.
5. Install equipment to facilitate servicing, maintenance, and repair or replacement of equipment components. Connect equipment for ease of disconnecting, with minimum of interference with other installations.
6. Install systems, materials, and equipment giving right-of-way priority to systems required to be installed at a specified slope.
7. Protect the structure, furnishings, finishes, and adjacent materials not indicated or scheduled to be removed.
8. Verify all dimensions by field measurements. Take measurements and be responsible for exact size and locations of all openings required for the installation of work. Figured dimensions are reasonably accurate and should govern in setting out work. Where detailed method of installation is not indicated or where variations exist between described work and approved practice, direction of the owner's representative on job shall be followed.
9. The symbols used to indicate the purpose of various outlets is identified in the
10. Legend.
11. The conductors terminating at each wired outlet shall be left not less than 8" long at their outlet fittings to facilitate installment and servicing of devices.
12. If during construction it becomes apparent that certain minor changes in layout will affect a neater job or better arrangement, such alterations shall be made as part of the contract. Designer's review shall be obtained before making such changes.
13. Workmanship throughout shall conform to the standards of best practice. Marks, dents or finish scratches will not be permitted on any exposed materials, fixtures or fittings. Inside of panels and equipment boxes shall be left clean.
14. All termination types shall correctly match cable and device termination point.
15. As an illustration if “spade lug” type of termination is appropriate then the spade lug cable entry size should match the cable used. The spade lug shall also have the correct stud size to match the terminal to which it will be connected. Terminations shall be completed with tools designed and sized for the specific application and connector.
16. Use caution not to exceed the manufacture allowed bending radius for cables and not to compromise the integrity of the cables during installation by pulling cable management devices too tightly, damaging cables, etc. Raceway/Cabling bending radii shall be minimum as directed by cable manufacturer. Use pulling compound or lubricant, where necessary, but ensure

that the type of compound is compatible with and will not deteriorate the conductor or cable insulation.

17. Neatly dress all cable work and provide vertical and horizontal cable management (or other approved method) for properly dressing all work at racks, control panels, backboards etc. See detail(s) and other drawings for additional information.
18. Low-voltage cables shall be kept as far from electrical cables and equipment as possible. Avoid running low-voltage cables parallel to medium and high-voltage cables. When parallel runs cannot be avoided, keep low-voltage cables at least 24 inches away and cross cables at 90 degrees to minimize the risk of interference.
19. Avoid running low-voltage cables any closer than 24 inches to any ballast type lighting fixture or other high RF energy producing device.
20. All cables shall be supported/anchored at maximum 4 foot intervals and within
21. 12" of box or outlet. All cables shall be neatly bundled and secured to discrete cable supports at four-foot intervals.
22. Furnish color-coded cable jackets to identify runs of different systems.
23. Neatly route cables parallel and perpendicular to building architectural lines.
24. Neatly comb out multiple cable bundled runs to remove tangling and crossing of cables within the bundles.
25. All cable assemblies, etc. shall be run as straight as possible and symmetrical (perpendicular to or parallel with) with architectural items and in a consistent elevation. Work installed diagonal to building members shall not be permitted.

B. Cable Separation
   1. Cables for each system shall be installed separately and isolated from cables from other systems.
   2. Cables carrying signals of different types and different nominal operating levels shall be kept separated to reduce the risk of undesirable interference and cross-talk between cables.
      a. As a general rule, for each 25dBV difference in nominal operating level between cables, Contractor shall provide at least 6 inches of separation. Example 1: cables with a 75dBV level difference between them shall be separated by 18 inches or greater. Example 2: Cables with a 13dBV difference between them shall be separated by 3 inches or greater.
      b. Contractor shall provide additional separation to prevent and to remedy any crosstalk that adversely affects the performance and usability of the system, or that exceeds specific crosstalk performance guidelines defined elsewhere in these specifications.
   3. In common areas where cables from multiple systems are run in general proximity to one another, cables from each system shall be labeled to identify the system the cables serve.

C. Cable Splices
   1. Splices shall not be permitted in any cable except where expressly specified and/or approved by the Designer.
   2. In cases where splices are specified and/or otherwise approved, splices shall be made within UL listed junction or device boxes. Open air connections shall not be permitted.

D. Cable Terminations
   1. Where field installed cables connect to manufacturered products via pig-tails or connectorized cable assemblies, all terminations shall be made within the product enclosure or within a UL approved junction or device box. Open air connections shall not be permitted. Exposed and open air spices are not acceptable.

E. Strain Relief Permanently installed cables shall be properly secured with an approved device. Strain relief shall be applied typically within 6-inches from the point of entry into a product enclosure, junction box, pull box, or device box. When properly applied the strain relief device shall not damage the cable being secured and shall not permit movement of the cable in any way that may adversely affect the long term integrity of nearby connections.

F. Identification
   1. General
      a. All identification shall be in English except where otherwise noted.
      b. Where identification is applied to surfaces that require a finish, install identification after the surface finish is applied.
      c. Labeling products, color, sizes, nomenclature and the installed location of the identification product are all subject to the Designer's review and approval.
   2. Cables
      a. Every installed cable shall be uniquely labeled at each end of the cable.
      b. Cables shall be labeled using permanent self-laminating type labels containing computer generated permanent type-written text.
      c. Nomenclature shall be bold-type and clearly readable by a person with average sight, and typical lighting conditions within the area of installation.
      d. Labels shall be applied approximately 6 cable-inches from the point of termination.
      e. Cables installed and intended for future use shall be clearly identified as such and the label shall clearly indicate the location of the opposite end of the cable.
      f. Every cable installed shall be recorded in the project record documents.
   3. Boxes
      a. Junction boxes and pull boxes shall be labeled on their interior and on their exterior covers with the identity of the system(s) the box serves along with the function of the box. Interior markings shall be made using permanent marker. Permanent marker may also be used on the cover of boxes installed in concealed areas (above accessible ceilings for example). Exposed boxes shall be labeled with engraved plastic cables. Labels shall closely match the color of the box.
      b. Device boxes, when first installed, shall be identified on their interior with a permanent marker to identify the system(s) the box servers and to identify the device the box will contain.
   4. Equipment Racks, Cabinets, Enclosures
      a. Engraved plastic labels shall be generated and applied to all equipment racks, cabinets, equipment enclosures, etc…
      b. The nomenclature, color, size, installed location, and type of all labels are subject to the Designer's review and approval.
   5. System Equipment

a. Each piece of active and passive system equipment shall be uniquely identified using labels and nomenclature acceptable to the Designer.
b. Front panel controls of equipment shall be labeled with nomenclature meaningful to the end user based on the intended use of the equipment in the system. Examples include, but are not limited to:
    1) Label router/matrix control panels with system specific input/output names.
    2) Label patch panels with meaningful input/output destination names
    3) Label mixer input and output controls to identify the signal source and destination.
c. Professionally prepared, installed and readily visible “cheat sheets” may be acceptable under select circumstances with the approval of the designer.
d. The nomenclature, color, size, installed location, and type of all labels are subject to the Designer’s review and approval.

G. Medium and High Voltage Cabling (> 71 Volts)
1. Cabling that will carry voltages higher then 71 Volts AC or DC shall be installed and terminated only by persons licensed to perform such work within the area of jurisdiction.

H. Plates and Panels
1. Device plates/panels shall be installed flush against the surface over which the plate/panel is mounted (e.g. there shall be no visible gap between the backside of a plate/panel and the wall, ceiling or floor; there shall be no visible gap between the backside of plate/panel and a surface mount box to which the plate/panel mounts). Advanced craftsmanship and construction techniques shall be employed where necessary to achieve this.
    a. The same shall apply to other wall and ceiling mounted products.
2. Cover plates shall match finish and color of other wiring devices in this project. Refer to Section 26 27 26 “Wiring Devices” for requirements.

I. Device Boxes, Pull-Boxes, Junction Boxes
1. Boxes installed in walls and ceilings shall be installed so that the box does not stand proud (protrude out beyond) of the finished surface. Boxes shall be installed such that when the mounted devices and cover plates are installed that the backside of the cover plate rests flush with the finished surface of the wall or ceiling. Advanced craftsmanship and construction techniques shall be employed where necessary to achieve this.

3.3 GROUNDING

A. All equipment shall be properly grounded for safety and to ensure satisfactory performance of systems and equipment.

3.4 CUTTING, PATCHING AND SEALING

A. General
1. The Contractor shall perform all cutting as required for the admission of work.

2. Unless directed otherwise in field, provide all related patching and painting tomatch surrounding methods, materials and colors. Any damage done by this Contractor to the building during the progress of this Contractor's work shall be made good at this Contractor's expense. Perform cutting, fitting, and patching and materials as required to:
   a. Uncover Work to provide for installation of ill-timed Work.
   b. Remove and replace defective Work.
   c. Remove and replace Work not conforming to requirements of these
   d. Contract Documents.
   e. Remove samples of installed Work as specified for testing.
   f. Install equipment and materials in existing structures.
3. Upon written instructions from the owner's representative, uncover and restore work to provide for observation of concealed work by owner's representative or by inspection authority having jurisdiction.
4. During cutting and patching operations, protect adjacent installations (structure, finishes, furnishings, etc.). Where applicable, provide and maintain temporary partitions or dust barriers adequate to prevent the spread of dust and dirt to system components and components of other trades.
5. Patch surfaces and building components using new materials matching existing materials and using experienced Installers. Refer to Division 1 for definition of experienced "Installer" or determine qualifications as directed in field by owner's representative.
6. Patching through fire rated walls and enclosures shall not diminish the rating of that wall or enclosure. All materials used for patching shall be installed to meet or exceed the smoke and fire rating of the respective surface being patched.
7. Neatly cut and drill all openings in walls and floors required for the installation.
8. Secure approval of Owner's Representative before cutting and drilling in existing facilities. Neatly patch all openings cut.
9. Cutting and patching shall be held to a minimum by arranging with other
10. Contractors for all sleeves and openings before construction is started.
11. Provide factory-assembled watertight wall and floor seals, of types and sizes required; suitable for sealing around conduit, pipe, or tubing passing through concrete floors and walls. Construct seals with steel sleeves, malleable iron body, neoprene sealing grommets and rings, metal pressure rings, pressure clamps, and cap screws.
12. Pipe sleeves shall be fabricated from Schedule 40 rigid, heavy wall, full weight galvanized steel pipe; remove burrs. Use sleeves which are two standard sizes larger than conduit passing through respective sleeve.
13. Provide sleeve seals for piping which penetrates foundation walls below grade, exterior walls or roofs, caulk between sleeve and pipe with non-toxic, UL-classified caulking material to ensure watertight seal. Elsewhere modular provide mechanical type seals, consisting of interlocking synthetic rubber links shaped to continuously fill annular space between pipe and sleeve, connected with bolts and pressure plates which cause rubber sealing elements to expand when tightened, providing watertight seal and electrical insulation.
14. Install standard Schedule 40 black steel pipe sleeves two sizes larger than pipes passing through floors, bearing walls, fire walls and masonry construction. Sleeves through walls shall be cut flush with both faces. Sleeves through floor shall extend one inch above floor top elevation. Pipes penetrating roof shall use

a pipe curb assembly. Furnish and set all forms required in masonry walls or foundation to accommodate pipes.

B. Grout
   1. Provide non-shrink, nonmetallic grout, pre-mixed, factory-packaged, non-staining, non-corrosive, and non-gaseous grout, recommended for interior and exterior applications.

C. General Joint Sealer Application
   1. Joint sealers, joint fillers, and other related materials compatible with each other and with joint substrates under conditions of service and application.
   2. Apply joint sealers under temperature and humidity conditions within the limits permitted by the joint sealer manufacturer. Do not apply joint sealers to wet substrates.
   3. Clean all affected surfaces, joints, etc. immediately before applying joint sealers to comply with recommendations of joint sealer manufacturer.
   4. Apply sealant primer to substrates as recommended by manufacturer. Protect adjacent areas from spillage and migration of sealant, using masking tape. Remove tape immediately after tooling without disturbing seal.
   5. Comply with joint sealer manufacturers' printed application instructions applicable to products and applications indicated, except where more stringent requirements apply.
   6. Immediately after sealant application and prior to time shinning or curing begins, tool sealants to form smooth, uniform beads; to eliminate air pockets; and to ensure contact and adhesion of sealant with sides of joint. Remove excess sealants from surfaces adjacent to joint. Do not use tooling agents that discolor sealants or adjacent surfaces or are not approved by sealant manufacturer.
   7. Colors for exposed seals shall be as selected by the Owner's representative from manufacturer's standard colors.

3.5 FIRESTOPPING

A. Cables and penetrations through building walls, floor and ceilings shall be fire-stopped in accordance with Code, these specifications and related drawings.

END OF SECTION 27 05 02

SECTION 27 05 26

GROUNDING AND BONDING FOR COMMUNICATIONS

PART 1 - GENERAL

1.1 SUMMARY

A. Provide the labor, tools, equipment, and materials necessary to furnish and install telecommunications grounding system in accordance with the plans and as specified herein. Provide all accessories as necessary for a complete system.

B. Provide communications system-grounding conductor at point of service entrance and connect to Telecommunications Main Grounding Busbar (TMGB). Bond together the communications system grounding.

C. This section includes the following:
   1. Telecommunications Main Grounding Busbar (TMGB)

1.2 SUBMITTALS

A. Product data for TMBG.

B. Ground resistance testing results certified by the testing organization.

C. Schematic diagram of the telecommunications grounding system.

1.3 QUALITY ASSURANCE

A. All equipment shall be UL listed and labeled for their intended usage.

B. All equipment shall comply with the latest National Electric Code.

C. All equipment shall comply with the latest TIA/EIA-607, and BICSI standards.

PART 2 - PRODUCTS

2.1 TELECOMMUNICATIONS MAIN GROUNDING BUSBAR (TMGB)

A. Provide Telecommunications Main Grounding Busbar (TMGB) in MDF Room.

B. The TMGB shall have minimum dimensions of ¼-inch thick x 4-inch wide and 12-inch in length. The length may need to be adjusted longer to meet the application

requirements with consideration of future growth. The busbar shall be UL Listed as grounding and bonding equipment.

C. The TMGB shall be a predrilled solid copper busbar provided with standard NEMA bolt hole sizing and spacing for the type of connectors to be used. The hole pattern for attaching grounding lugs shall meet the requirements of ANSI-J-STD – 607-A and shall accept 15 two-hole grounding lugs with 5/8" hole centers and 3 two-hole lugs with 1" hole centers. The busbar shall include wall-mount stand-off brackets, assembly screws and insulators creating a 4" standoff from the wall.

PART 3 - EXECUTION

3.1 INSTALLATION

A. As a minimum, Bond TMGB to following:

1. Building Steel (minimum #1/0 AWG insulated copper bonding conductor). Attach Bonding Conductors to Building Steel using listed exothermic welding process.
2. Main Electrical Service Ground (minimum #1/0 AWG insulated copper bonding conductor).
3. Local Service Panel Ground.
4. Associated Telecommunications Cable Tray(s).
5. Telecommunications Conduit(s) Entering TR.

B. As a minimum, the Technology Contractor shall bond the following devices to the associated TMGB using a minimum #6 AWG insulated copper bonding conductor using 2-hole compression style lugs:
1. Equipment Racks and Cabinets
2. Cable Ladder and Tray
3. Surge Protectors
4. Telecommunications Devices
5. Coupled Bonding Conductors (CBCs)
6. Backbone Cable Shields
7. Telecommunication and Fiber Cable Shields

C. General:
1. Route ground conductors to provide the shortest, most direct path from point to point. Telecommunications ground must be bonded to the lightning protection system ground.
2. Bonding conductors should not be placed in ferrous metallic conduit. If it is necessary to place bonding conductors in ferrous metallic conduit that exceeds 3 feet in length, the conductors shall be bonded to each end of the conduit with a conductor sized as a #6 AWG, minimum (this makes the conduit a parallel path with the cable).
3. A continuous ground path shall be provided in all telecommunications raceways. Grounded cable trays shall be considered continuous ground path.
4. Any grounding or bonding conductor that is run through a metallic conduit shall be bonded to the conduit.

D. Telecommunications Entrance Facility (TEF) Telecommunications Main Grounding Busbar (TMGB):
   1. The Telecommunications Main Grounding Busbar (TMGB) serves as the dedicated extension of the building grounding electrode system for the telecommunications infrastructure.
   2. Where an electrical panelboard is located in the same room or space as the TMGB, the ground or enclosure of that electrical panelboard shall be bonded to the TMGB. Locate the TMGB as close to the electrical panelboard as practical to maintain clearances required by applicable electrical codes.
   3. Telecommunications primary protector grounding conductor shall be bonded to the TMGB. A minimum of 1 foot separation shall be maintained between this insulated conductor and any DC power cables, switchboard cables, or high frequency cables, even when placed in metal raceway.
   4. All metallic raceways for telecommunications cabling located within Equipment Room (ER) shall be bonded to the TMGB. However for metallic raceways containing grounding conductors where the raceway is bonded to the ground conductor, no additional bonding to the TMGB is required.
   5. In buildings where the backbone telecommunications cabling incorporates a shield or metallic member, this shield or metallic member shall be bonded to the TMGB where the cables are terminated or where pairs are broken out.
   6. In a metal frame (structural steel) building, where the steel framework is readily accessible within or external to the mdf; each TMGB shall be bonded to the vertical steel metal frame.

3.2 FIELD QUALITY CONTROL

A. Testing Telecommunications Grounding and Bonding Infrastructure:
   1. Inspect grounding and bonding system conductors and connections for tightness and proper installation.

B. Measure ground resistance from longest grounding path to TMGB. Resistance shall not exceed 0.1 ohms

END OF SECTION 26 05 26

SECTION 27 05 28

PATHWAYS FOR COMMUNICATIONS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Complete and working pathway systems for communications and related system cabling, including pathways designated as spare(s) and/or reserved for future use
   2. Section includes but is not necessarily limited to:
      a. Conduit, fittings and supports
      b. Surface raceway, fittings and supports
      c. Discrete cable supports, fittings and supports
      d. Cable tray, fittings and supports
      e. Wall, floor, ceiling and roof penetrations
      f. Miscellaneous pathway accessories

1.2 DEFINITIONS

A. Primary Pathways – Those pathways typically located in corridors, dedicated vertical cable chases and used to enclose and/or support large quantities of compatible signal cables from one or more systems to the general area where system devices are located. Cables carried by a primary pathway transfer to secondary pathways.

B. Secondary Pathways - Those pathways typically extending from a primary pathway to the space near the system device to be served. A secondary pathway typically accommodates 16 or less cables of compatible signals, from a single system.

1.3 SYSTEM DESCRIPTION

A. General
   1. The pathway systems for communication shall consist of all products necessary to support, protect, enclose, manage and secure cables used for communications and related systems. The pathway system for each system may vary based up the requirements of these specifications and information on the drawings.
   2. The total pathway system shall include code-compliant penetrations through walls, floors, ceilings, roofs, etc… as necessary for the routing of cables between their intended starting and ending points.

B. Pathway System(s) for Telecommunications (Voice/Data/Network) Cabling
   1. The pathway system for the Telecommunications cabling system shall be a hybrid pathway system consisting of a mixture of cable tray, conduit, discrete cable supports, conduit sleeves, and device boxes, pull boxes and junction boxes.

2. The pathway system shall be assembled from UL listed components.
3. The pathway system shall be NFPA 70 and the “National Electrical Code”
4. compliant.
5. The pathway system shall be built so that no pathway segment shall exceed a
6. 40% cable fill. Larger pathway segments (conduits, cable tray, discrete cable supports etc…) shall be provided where indicated on the drawings.
7. The pathway system shall include all products necessary to render the system usable for its intended purpose
8. The minimum conduit size permissible for use in this system shall be 1”.

C. Pathway System(s) for other Communications Systems
   1. General
      a. Unless otherwise noted on the drawings, the pathway system for each of the following systems shall be a hybrid pathway system consisting of a mixture of cable tray, conduit, discrete cable supports, conduit sleeves, and device boxes, pull boxes and junction boxes.
      b. The pathway system shall be assembled from UL listed components.
      c. Conduit sizes used for the system shall support a cable fill percentage not exceeding 40%. Larger pathway segments (conduits, cable tray, discrete cable supports etc…) shall be provided where indicated on the drawings.
      d. Each system shall include all products necessary to render the system usable for its intended purpose
   2. Building Intercommunication Systems
      a. Minimum conduit size for this system is 3/4”.
   3. Paging Systems
      a. Minimum conduit size for this system shall be 3/4”.
   4. Audio/Visual Systems
      a. Minimum conduit size is 3/4”.
   5. Sound Reinforcement Systems
      a. Minimum conduit size is 3/4”.
   6. Pathways for other work of Division 27
      a. Minimum conduit size is 3/4”.

1.4 SUBMITTALS

A. Product Data
   1. Surface Raceway
   2. Cable Tray
   3. Floor Boxes
   4. Device Boxes
   5. Box Eliminators
   6. Cable Spillways
   7. Discrete Cable Supports

B. Shop Drawings
   1. Floor plans depicting the intended location of the following:
      a. Primary pathways
      b. Secondary pathways
      c. Planned penetrations through ceilings, floors, walls and the roof.

2. Riser diagrams of each closed conduit systems used by communication systems.

C. Closeout Submittals
1. Floor plans depicting the as-installed location of the following:
a. Primary pathways
b. Secondary cabling pathways
c. Locations of all penetrations and conduit sleeves
d. Fire-rated penetration locations, along with rating value.
2. Penetration Certification Documentation
a. Certification paperwork for all penetrations through fire-rated building surfaces and cavities.

1.5 QUALITY ASSURANCE

A. All products shall be UL–type listed for the location and application in which it is used.
1. All onsite personnel shall be manufacturer trained on the anchoring system being utilized.
2. Building penetrations shall be performed by person(s) properly trained on the installation of specific rated assembly being installed.
3. Installation material and practices shall fully comply with NFPA 70, “National Electrical Code” and ANSI/TIA/EIA 569A Commercial Building Standard for Telecommunications Pathways and Spaces.

PART 2 - PRODUCTS

2.1 RACEWAYS

A. Conduit
1. Rigid steel conduit:
a. Threaded rigid steel conduit shall be manufactured from mild steel, zinc galvanized both inside and outside including threads. It shall be constructed in accordance with ANSI C80.1, Federal Specification WW-C-581;
2. Intermediate metallic conduit:
a. Threaded intermediate metallic conduit shall be manufactured from mild steel, zinc galvanized both inside and outside including threads. It shall be constructed in accordance with ANSI C80.6, Federal Specification WW-C-581;
3. Electric metallic tubing:
a. Electric metallic tubing shall be manufactured from mild steel, zinc galvanized both inside and outside. It shall be constructed in accordance with ANSI C80.2, Federal Specification WW-C-563;
4. Flexible metallic conduit:
a. Flexible metallic conduit with neoprene jacket shall be spirally wound steel, strip zinc galvanized both inside and outside, integral ground conductor.
5. Non-metallic raceways
a. Polyvinylchloride (PVC):

1) PVC conduit shall be virgin C300 type, Schedule 40 or 80 (90□ C).
2) Constructed in accordance with NEMA TC2 and Federal Specifications W-C-1094A.

B. Discrete Cable Supports (J-Hooks)
1. General
a. Discrete cable supports with round surfaces (i.e. bridal rings) are not acceptable for use.
2. Primary Pathways
a. J-Hook style support.
b. Plenum rated construction.
c. Steel construction, galvanized finish
d. Complies with UL, cUL, NEC, and ANSI/TIA/EIA requirements for structured cabling systems.
e. Basis of Design:
1) 50 UTP Category 6 cable capacity: Erico CABLECAT32xx
2) 185 UTP Category 6 cable capacity: Erico CABLECAT34xx
f. Additional approved manufacturers: B-Line, Panduit
g. See manufacturer's installation guidelines for additional quantity and sizing guidelines.
3. Secondary pathways
a. Plenum rated.
b. J-hooks style support
c. Steel construction, galvanized finish
d. Complies with UL, cUL, NEC, and ANSI/TIA/EIA requirements for structured cabling systems.
e. Basis of Design:
1) 10 UTP Category 6 cable capacity: Erico CABLECAT12xx
2) 32 UTP Category 6 cable capacity: Erico CABLECAT21xx
f. Additional approved manufacturer(s): B-Line, Panduit
g. See manufacturer's installation guidelines for additional quantity and sizing guidelines.

2.2 FITTINGS

A. Rigid steel or intermediate metallic conduit:
1. Fittings shall be threaded zinc galvanized steel.
2. At least one bushing shall be grounding type
a. Equipped with a ground lug
b. Provide on each conduit or sleeve where surface extends below ceiling line.

B. Electric metallic tubing:
1. Fittings shall be compression type.
2. At least one bushing shall be grounding type
a. Equipped with a ground lug
b. Provide on each conduit or sleeve where surface extends below ceiling line.

C. Flexible metallic conduit:

1. Fittings shall be suitable for the specific application.
2. Use oil-tight fittings with neoprene jacketed flexible metallic conduit.

D. Non-metallic conduit:
1. Fittings shall be of the same type and manufacturer as the raceway, connected in accordance with manufacturer's written instructions.

E. Expansion:
1. Expansion fittings shall be of a type suitable for the particular condition and shall be complete with bonding jumper.

2.3 BOXES

A. Wall/Ceiling Outlet Style Device Boxes
1. General:
   a. Stamped steel, code gauge, galvanized, minimum 2 ½ inches deep. Provide deeper boxes where indicated on the drawings.
   b. Corrosion protection suitable for the atmosphere in which they are installed.
   c. Non-gangable sheet-steel box construction
   d. Conduit knockouts of the size and quantity and box locations required.
   e. Threaded device mounting screw holes.
   f. Rated for installation in the space where the box will be installed
2. Boxes Used in Masonry or Tile Walls
   a. Galvanized steel construction
   b. "Masonry" style box construction
   c. Available in standard gang sizes from 1 to 6
   d. Various depth sizes available from 2.5 to 3.5 inches
   e. Conduit knockouts to suit the application
3. Boxes used in Gypsum Board Walls
   a. Galvanized steel construction
   b. "Masonry" style box construction
   c. Available in standard gang sizes from 1 to 6
   d. Various depth sizes available from 2.5 to 3.5 inches
   e. Conduit knockouts to suit the application
4. Approved Manufacturers: Adalet, Appleton Electric, Bell Electric, Bowers, Eagle Electric, Mfg Co., Inc., Midland-Ross Corp., OZ/Gedney., Pass and Seymour, Inc., RACO, Hubbel, Thomas & Betts Co., Thepitt.

B. Exterior Surface Mount Outlet Style Boxes
1. Hinged cover, sized to accommodate the devices being mounted to the box.
2. Cast Aluminum construction
3. Available in standard gang sizes from 1 to 3
4. Threaded conduit hubs
5. Approved Manufacturers: Adalet, Appleton Electric, Bell Electric, Bowers, Eagle Electric, Mfg Co., Inc., Midland-Ross Corp., OZ/Gedney., Pass and Seymour, Inc., RACO, Hubbel, Thomas & Betts Co., Thepitt.

C. Surface Raceway Device Boxes
1. Designed to work with the surface raceway system to which they attach

2. Factory finished to matching the associated raceway.
3. Available in standard gang sizes of 1 to 3 gangs.
4. Sized to suit the devices they are intended to accommodate.
5. Available in a variety of box depths, including custom manufactured box depths up to 3-1/2 inches.

D. Junction and Pull boxes:
1. Conduit System Junction and Pull Boxes
   a. Screw cover type enclosure, except where otherwise noted.
   b. Screw covers installed in unfinished spaces, above ceilings, in utility rooms shall be provided with covers of the same finish and material construction as the box itself.
   c. Boxes installed flush in wall shall be provided with oversize cover plates painted to match the surrounding building surface.
   d. Boxes shall be NEMA rated for the atmospheric condition in which the box is installed.
   e. Boxes in exterior or moist locations shall meet NEMA 3R (at minimum)
2. Surface Raceway Junction and Pull Boxes
   a. As manufactured by the surface raceway manufacture and designed to work with the surface raceway system installed

2.4 PENETRATIONS

A. Sleeves Through Floors and Walls
1. All penetrations through floors or walls shall require a UL listed device for the purpose of penetrating the construction.
   a. Concrete, block, brick, and gypsum drywall construction providing a fire rating of greater than one hour for walls and floors will require a UL rated sleeve assembly installed to manufacturer's requirements allowing the penetration(s) to not degrade the designed fire rating of the wall or floor.
      1) Basis of Design: as manufactured by Unique Fire Stop Products (USFP). Utilize USFP's Threaded Penetrator system for all fire- rated penetrations.
   b. All other penetrations and gypsum drywall constructed walls providing a fire rating of one hour or less will require a UL rated sleeve assembly installed to manufacturer's requirements allowing the penetration(s) to not degrade the designed fire rating of the wall or floor.
      1) Basis of Design: as manufactured by Unique Fire Stop Products (USFP). Utilize USFP's Smooth Penetrator system for all fire-rated penetrations.
   c. All penetrations found to be improperly sleeved after the installation of cabling will be sleeved and firestopped to restore the proper aesthetics and required fire rating to the obstruction.
      1) Basis of Design: as manufactured by Unique Fire Stop Products (USFP). Utilize USFP's split-sleeve system for all fire rated penetrations.
2. Penetrations into fire rated walls with gypsum board construction.
   a. All penetrations required in gypsum board walls for installation of horizontal cabling, where conduit is not stubbed into the ceiling cavity for

this purpose, will require a sleeved penetration through the drywall membrane or the wall cap.
1) Each penetration will require a UL listed sleeve assembly installed by an installer trained on proper installation of the sleeving device.
2) Basis of Design: as manufactured by Unique Fire Stop Products (USFP). Utilize USFP's Membrane Penetrator or Cap Penetrator system for all fire rated penetrations.

3. Basis of Design: Unique Fire Stop Products.
4. Additionally Approved: Field fabricated systems (inspected and approved by the code authority having local jurisdiction)

2.5 ACCESSORIES

A. Pull Strings
1. Pull strings shall be nylon type as manufactured by Arnco.
2. Additional Approved Manufacturers: Greenlee, Condux

B. Fiber Optic Inner Duct
1. NEMA TC 5, UL listed, corrugated, specifically designed for optical fiber cable pathways.
a. Color : Orange
b. 1-inch minimum inside diameter
c. 600 pounds minimum pulling strength
d. Factory installed pull rope
e. Rated for the environment in which it is installed.
f. Riser Rated Environments:
1) Basis of Design: Carlon DF4X1C-xxxx
g. Plenum Rated Environments:
1) Carlon CF4X1C-xxxx for installation in Plenum environments.
h. Additional Approved Manufacturers: Arnco, Endot, Opti-Com, Pyramid

C. Cable Spillways
1. On 4-Inch Sleeves
a. Cable Management Corp. Model CM-1004 Cable Spillway.
b. Additional Approved Manufacturers: B-Line, Chatsworth
2. On 2-Inch Sleeves
a. Cable Management Corp. Model CM-1002 Cable Spillway on two-inch sleeves.
b. Additional Approved Manufacturers: B-Line, Chatsworth

D. Supports
1. General
a. Supports, support hardware, and fasteners shall be protected with zinc coating or with treatment of equivalent corrosion resistance using approved alternative treatment, finish, or inherent material characteristic.
b. Products used outdoors shall be hot-dip galvanized.
2. Material Types
a. Concrete and Masonry Anchors:
1) Basis of Design: As manufactured by Hilti.
b. Raceway Supports:

1) Clevis hangers, riser clamps, conduit straps, threaded C-clamps with retainers, ceiling trapeze hangers, wall brackets, and spring steel clamps.

c. Fasteners:
   1) Types, materials, and construction features as follows:
      a) Expansion anchors: Carbon steel wedge or sleeve type
      b) Toggle bolts: All steel springhead type
      c) Powder-driven threaded studs: Heat-treated steel, designed specifically for the intended service

d. Conduit Sealing Bushings:
   1) Factory-fabricated watertight conduit sealing bushing assemblies suitable for sealing around conduit or tubing passing through concrete floors and walls. Construct seals with steel sleeve, malleable iron body, neoprene sealing grommets or rings, metal pressure rings, pressure clamps, and cap screws.

e. Cable supports for vertical conduit:
   1) Factory-fabricated assembly consisting of threaded body and insulating wedging plug for non-armored electrical cables in riser conduits.
   2) Furnish with plugs with the number and size of conductor gripping holes as required to suit each individual application.
   3) Body construction: Malleable-iron casting with hot-dip galvanized finish.

f. Threaded Rod Stock (All-Thread Rod)
   1) Available in ¼", 3/8", ½", and 5/8" sizes.
   2) Rod lengths over 6' will require a "Rod Stiffener" installation for ½" and 5/8" rods.
      a) A section of U-Channel stock is placed around the rod and stiffener clamp assemblies used to clamp to rod.
      b) Place clamps a minimum of 6" from the top and bottom of the rod and every 18" in between.
      c) Basis of Design: B-Line SC228
         Additional approved manufacturer(s):
         Unistrut Diversified Products
         GS Metals Corp.
         Haydon, Corp.
         Kin-Line Inc.

g. Slotted Met
   1) 16-gauge steel channels, with 9/16 inch diameter holes, at a minimum of 8 inches on center, in top surface. Provide fittings and accessories that mate and match with U-channel and are of the same manufacture.
   2) Basis of Design: Unistrut Diversified Products
   3) Additional Approved Manufacturers: Allied Tube & Conduit, American Electric, B-Line Systems, Inc., Cinch Clamp Co., Inc., GS Metals Corp., Haydon Corp., Kin-Line Inc.

E. Bushing, Knockout Closures and Locknuts
   1. Provide corrosion-resistant box knockout closures, conduit locknuts and malleable iron conduit bushings, offset connectors, of types and sizes, to suit respective installation requirements and applications.

PART 3 - EXECUTION

3.1 COORDINATION

A. Coordinate the layout and installation of raceway and boxes with the work of this and other Divisions; work of other trades; and with existing construction elements to ensure adequate headroom, working clearances, and to allow for post installation access.

3.2 INSTALLATION

A. General
   1. Size all new pathways so as to ensure maximum fill ratios will not be exceeded when the systems cabling they serve is installed. Where drawings indicate the use of larger conduit sizes, install the larger sizes as indicated.
   2. Install above-grade raceways, and cable tray parallel to and/or perpendicular to building elements.
   3. Install pathways level, except where elevations changes are required for installation.

B. Raceways
   1. Except as otherwise noted and/or detailed on the drawings, install the following types of raceways as defined below
      a. Rigid Galvanized Steel (GRC):
         1) Above grade, outside the building envelope, in exposed areas.
         2) Above grade, inside the building envelope, in high moisture areas.
      b. Electric Metallic Tubing (EMT):
         1) Within the building envelope.
      c. Polyvinylchloride (PVC):
         1) Below grade (except where otherwise noted on the drawings).
      d. Flexible Metal Conduit (FMC):
         1) Flexible metal conduit shall only be used between a secondary pathway and a device location and shall only be used where it is expressly indicated on the drawings.
         2) Maximum length of any FMC path shall not exceed 6 meters.
   2. Conduit
      a. Install all conduit terminations with locknuts and bushings. Provide conduits 1 ½ inches and larger with insulating bushings and locknuts inside and outside the enclosure.
         1) At least one bushing per conduit shall be grounding type, equipped with a grounding lug.
         2) Ground conduit system required by code and in accordance with the grounding and bonding specifications and related drawings.
      b. Support conduits by pipe straps or trapeze hangers. Space supports not more than 8 feet on center. Secure supports by means of toggle bolts, inserts or expansion bolts.
      c. Space wall brackets supporting conduits not more than 4 feet 6 inches on center. Secure supports by means of toggle bolts, inserts or expansion bolts.

d. Support raceway components directly from structural building systems, not from ceiling suspensions systems. Provide supplemental supports for junction or pull boxes.
e. Conceal conduit raceways under floors, in walls, above ceilings and in furred spaces within finishes building areas.
f. Support single conduits 1 ½ inches and larger by means of rod and cast ring hangers. Support multiple runs in similar manner or use common trapeze hanger.
g. Provide two-hole sheet metal pipe straps for all surface mounted conduit supports on walls up to a height of 8 feet above the finished floor.
h. Pinch type hangers similar to minerallac type shall only be used at heights greater than 8 feet.
i. Protect conduits during construction with temporary plugs or caps.
j. Securely cap all conduits until wire or cable is installed. Do not install conduit in concrete slab.
k. Provide expansion fittings where raceway crosses the building expansion joints. (O.X. Type AX, EX, EXDS, TX, EXE).
l. Conduit Routing
    1) If specific routing information appears on the drawings, route and maintain conduits as shown. Should interference or conflict arise, the Contractor shall inform the Designer before proceeding with the Work.
    2) If specific routing information does not appear on the Drawings, Contractor shall determine the best route for the conduit in accordance with code and other specified guidelines.
m. Conduit bends
    1) Bends shall be made so that the conduit will not be flattened or kinked and the internal diameter of the conduit will not be reduced.
    2) The radius of the curve of the inner edge of any bend shall not be less than as indicated by the National Electrical Code and ANSI/TIA/EIA 569A Commercial Building Standard for Telecommunications Pathways and Spaces.
    3) In no case shall any conduit be bent or shall any fabricated elbow be applied to less than the allowable bending radius as specified by the cable manufacturer of the installed conductor.
    4) When necessary to make field bends, use tools designed for conduit bending.
        a) Heating of metallic conduit to facilitate bending is not permitted.
    5) Constructing an outside entrance to a building from buried conduit to penetrate above the ceiling line will allow an exception for a 4” LB fitting at one end to allow placement of the conduit flat to the building outside wall.
n. The Contractor shall not cut, burn, or drill any structural member to mount electrical equipment or to facilitate tray or conduit installations without having previously received approval, in writing, from the Architect/Engineer/Consultant.
o. Install above-ceiling conduits a minimum of 7 inches above ceiling tiles so as to permit ceiling tile removal
p. Install conduits at least 6 inches from insulated pipes, steam lines or any other hot pipes they pass. Where the lines are not insulated, the

clearances shall be increased until the temperature of the conduit, with no live conductors enclosed, does not rise above the ambient temperature of the installation area.

q. Conceal all raceways except where otherwise indicated.
r. Install flashing and counter flashing or pitch pockets for waterproofing of all raceways, outlets, fittings, etc. that penetrate the roof.
s. Install sleeves in forms for new concrete walls, floor slabs, and partitions for passage of raceways.
    1) Seal sleeves in an approved manner that pass through fire rated walls, floors, and ceilings, following raceway installation.
t. Waterproof all sleeved raceways in areas prone to high moisture and condensation.

3. Surface Raceway
    a. Install surface raceway in areas indicated on drawings.
    b. Coordinate installation with casework prior to the installation of casework and raceway.
    c. Install raceway, accessories and device boxes plumb and level.
    d. Anchor raceways to walls with the anchors designed for the wall construction encountered.
    e. Secure raceway at intervals of not more then 2 feet, and not less than 6 inches from the ends of each raceway.
    f. Install raceway per the manufacturer's written recommendation, including necessary entrance, ending and bend fittings.
    g. Furnish and install all of the manufacturer's recommended fittings and accessories.
    h. Where surface raceway is provided for a secondary pathway from the outlet to the ceiling space, extend surface raceway into the ceiling space not less than 4 inches.
4. Pull Boxes
    a. Install all pull boxes as indicated on the drawings.
    b. Install pull boxes every 180 degrees of conduit bends
    c. Install pull boxes within the building every 100 feet of conduit.
    d. Install pull boxes for underground conduits at intervals not more then 600 feet of conduit. Install more frequently as required by Code.
    e. Install pull boxes in areas that will be accessible after installation.
        1) Accessible areas include above accessible ceiling, snap-in ceilings, and behind access doors.
    f. Support and size boxes in accordance with the N.E.C.
    g. Land conduits on the box so conduit entry will permit the longest radius for conductors contained therein.
    h. Provide junction and pull boxes such that conduits enter and exit across from each other on opposite sides of the junction box.
    i. Do not use pull boxes in lieu of conduit bends.

C. Pull Stings
1. Install a usable pull string in every pathway prior to the installation of cables.
2. This string shall be used to aid in the installation of system cables.
3. Install a usable pull string each pathway during the installation of cable(s) within the pathway. This string be tied off and shall remain available for future use.

D. Inner Duct

1. Install appropriately sized inner duct in all pathways that will be used to enclose and support fiber optic cables.
    a. Inner duct is not required in those pathways containing exclusively Armored-type fiber optic cables.
2. Plenum rated inner duct shall be used in pathways that are not 100% conduit.

E. Spillways
1. Install cable spillways where cabling exits a conduit sleeve, cable tray, etc. where cable(s) will be unsupported for more than six inches.

F. Telecommunications / Power Poles
1. Mount straight and anchor to building structure above the ceiling line.
2. Provide mounting hardware, entrance end fitting, and ceiling trim plate.
3. Coordination and Positioning
    a. Coordinate positioning with other trades to assure maximum accessibility.
        1) Tray shall be mounted securely along the wall at a minimum of 6” (lower tier) above the ceiling line.
        2) Where two 12” trays connect to a two tier unit, the upper tray may continue at 12” (upper tier) above the accessible ceiling.
        3) Where tray cannot be wall mounted, (transversing hallways, etc.) mount span securely to wall at each end and provide ½” threaded rod supports, anchored into the concrete deck above, every 4’ at minimum.
        4) Minimum access should be 12 inches clear above the tray (each tier) and 12 inches clear beside the tray to facilitate moves, adds and changes for telecommunications cabling.

G. Discreet Cable Supports (J-Hooks)
1. Discrete cable supports shall be installed to support cables in areas that are readily accessible after installation (example: above accessible suspended ceiling).
2. Enclosed raceways systems shall be used in lieu of discrete cable supports where cables must pass through inaccessible areas.
3. Install separate supports for cables from every system, and install separate supports for incompatible cables from the same system. Array supports vertically using the appropriate spacing.
4. Attach supports directly to vertical building surfaces, or from overhead structural members using threaded rod and other approved attachment methods.
5. Install supports plumb and square.
6. Mount bottom of supports approximately 12” above suspended ceilings.
7. Cable supports shall be installed at intervals not exceeding 5’ feet.
8. Adjacent supports shall be installed at the same elevation except where necessary for coordination with other trades and pathways of other systems.
9. Install supports so that they do not interfere with the ability to remove ceiling tiles.
10. Support with threaded rod and U-channel supports systems.
11. Discrete Support Sizing and Quantity
    a. Do not exceed 75% of the permissible fill capacity of any support provided.
    b. Install multiple supports as required to handle the total quantity, size and type of cables served.

c. After installation of cables, 25% of rated permissible fill capacity shall be reserved of future use.

12. Discrete Support Usage and Quantity
    a. Use separate supports for cables from difference systems
    b. Use separate supports to carry cables of incompatible signals from the same system.

H. Device Boxes
1. New-work and old-work device boxes shall be installed flush with or slightly recessed below the finished surface (but no more then code allow, nor more then .078-inches (2mm)). Old work boxes require advanced craftsmanship and construction techniques to achieve this.
2. Installed height of boxes shall generally be as indicated on the drawings. Installed heights shall be adjusted in the field to ensure a clean appearance that results from coordinating with existing installed box heights and new boxes being installed to serve non-communications systems. Where the specified box height and existing condition boxes differ by more then 2-inches, seek the direction of the Designer prior to installation.
3. Device boxes and their associated cover plates shall not span different types of wall finishes either vertically or horizontally. Horizontal and vertical position of boxes shall be adjusted at time of installation to ensure that this condition does not exist after installation.
4. Boxes in masonry shall be installed so that the specified over plates will cover the mortar joints and cut openings completely.
5. Device boxes shall be installed so that they are securely and rigidly attached to the building by any of the following methods:
    a. Double bar installation for metal stud walls. Bar hanger punch, mounting clips, and retainer clips shall be used in strict accordance with manufacturer's instructions. Factory pre-punched stud holes shall not be used to support the bar hangers.
    b. Steel stud installed behind box for support without "*caddy-type"* mounting clips for metal stud wall construction.
    c. "Caddy-type" screw gun bracket installed behind box for support. Installation shall be per manufacturer's instructions.
6. Devices boxes shall not rely on the raceway as their primary means of support. Boxes shall be attached to surrounding building structure.
7. Device boxes shall be installed plumb and level, held to within all of the following limits:
    a. Maximum one-tenth (1/10) of one degree from plumb and from level, and;
    b. Maximum difference from level of .078-inches (2mm) at one end of the box relative to the other end of the box, and;
    c. Maximum difference from plumb of .078-inches (2mm) at the top of the box relative to the bottom of the box;
8. Boxes shall be shimmed as necessary to insure level and plumb installation.
9. Install gaskets on all boxes installed outside and in wet or damp locations (tunnels, crawlspaces, pits, etc.).
10. Device boxes shall be protected from plaster.
11. Floor boxes shall be installed flush and true with the finished floor.
12. Boxes shall be cleaned of debris after installation.
13. Boxes shall be cleaned of debris thoroughly prior to installation of cover plates;
14. Install blank cover plates on each unused device box.

I. Penetrations
   1. Sleeves Through Floors and Walls
      a. Install conduit sleeves where indicated on the drawings and wherever cables or raceways will pass through floors, walls, ceilings, and any concrete or masonry structure, except where tunnels, chases or shafts are provided in the project site construction.
         1) Sleeves through poured-in-place concrete surfaces shall be set in place prior to the concrete pour and shall be of a design that seals against the passage of water between the sleeves and concrete floor.
      b. Install cable protecting bushings on the each end of each sleeve.
      c. Extend all through-the-wall sleeves a minimum of 2 inches beyond the wall surface, longer as required, to allow installation of conduit bushings.
      d. Extend through-the-floor sleeves 4 to 6 inches above finished floors, except where otherwise noted on the drawings.
      e. Voids between the sleeve and the building surface shall be neatly finished and filled with approved fire stop material.
   2. Labeling
      a. Install penetration certification next to each penetration through fire-rated surfaces.

J. Supports
   1. Fabricated Supporting Devices
      a. Conform to the manufacturer's recommendations for selection and installation of supports.
      b. The strength of each support shall be adequate to carry present and planned future load multiplied by a safety factor of at least four. Where this determination results in a safety allowance of less than 200 lbs. provide additional strength until there is a minimum of 200 lbs. safety allowance in the strength of each support.
      c. Install individual and multiple (trapeze) raceway hangers and riser clamps as necessary to support raceways. Provide U-bolts, clamps, attachments, and other hardware necessary for hanger assembly and for securing hanger rods and conduits.
      d. Support parallel runs of horizontal raceways together on trapeze-type hangers.
      e. Support individual horizontal raceways by separate pipe hangers. Spring steel fasteners shall be used in lieu of hangers for 1 ½ inch and smaller raceways serving lighting and receptacle branch circuits above suspended ceilings only.
      f. For hanger rods with spring steel fasteners, use ¼ inch diameter or larger threaded steel. Use spring steel fasteners that are specifically designed for supporting single conduits or tubing.
      g. Support exposed and concealed raceway within 1 foot of an unsupported box and access fittings. In horizontal runs, support at the box and access fittings shall be omitted where box or access fittings are independently supported and raceway terminals are not made with chase nipples or threadless box connectors.
      h. In vertical runs, arrange support so the load produced by the weight of the raceway and the enclosed conductors is carried entirely by the conduit supports with no weight load on raceway terminals.
   2. Miscellaneous supports

a. Support miscellaneous electrical components as required to produce the same structural safety factors as specified for raceway supports. Install metal channel racks for mounting cabinets, pull boxes, junction boxes, and other devices.
b. Support sheet metal boxes directly from the building structure or by bar hangers.Where bar hangers are used, attach the bar to raceways on opposite sides of the box and support the raceway with an approved type of fastener not more than 24 inches from the box.

3. Fastening:
   a. Unless otherwise indicated, fasten electrical items and their supporting hardware securely to the building structure, including but not limited to; conduits, raceways, cables, cable traps, busways, cabinets, panel boards, transformers, boxes, disconnect switches, and control components in accordance with the following:
      1) Fasten by means of wood screws or screw-type nails on wood, toggle bolts on hollow masonry units, concrete inserts or expansion bolts on concrete or solid masonry, machine screws, welded threaded studs, or spring-tension clamps on steel. Threaded studs driven by a powder charge and provided with lock washers and nuts shall be used instead of expansion bolts and machine or wood screws. Do not weld conduit, pipe straps, or items other than threaded studs to steel structures. In partitions of light steel construction, use sheet metal screws.
      2) Holes cut to depth of more than 1 ½ inch in reinforced concrete beams or to depth of more than ¾ inch in concrete shall not cut the main reinforcing bars. Fill holes that are not used.
      3) Ensure that the load applied to any fasteners does not exceed 25 percent of the proof test load. Use vibration-and shock-resistant fasteners for attachments to concrete slabs.
   b. Raceway supports: Hanger spacing shall be as required for proper and adequate support of the raceway, but in no case shall be less than one hanger per 5 feet of raceway length.

K. Ground and Bonding
   1. Ground and bond raceway systems in accordance with the NEC and ANSI/TIA/EIA 607. See Related Drawings and Specifications for additional information.

3.3 TRAINING

A. Review the pathway system(s) with the Owner's facility management personnel, and other owner designated personnel responsible for ongoing maintenance of systems installed within the pathways.

B. Review all key pathway paths and expansion capabilities

END OF SECTION 27 05 28

SECTION 27 05 53

IDENTIFICATION FOR COMMUNICATIONS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Labeling of Communications Systems, Equipment and Rooms
   2. System includes but is not limited to:
      a. Communications product identification labels
      b. Communications room labels
      c. Communications Key Drawings

1.2 REFERENCES

A. ANSI/TIA/EIA-606 – The Administrative Standard for the Telecommunications Infrastructure of Commercial Building.

B. “TELECOMMUNICATIONS DISTRIBUTION METHODS MANUAL” published by the Building Industry Consulting Services International (BICSI).

1.3 SYSTEM DESCRIPTION

A. Identification of Communications shall consist of professionally created and applied labeling products for the following types of Communications products.
   1. Cabling
   2. Equipment racks
   3. Equipment enclosures
   4. Patch panels
   5. Device plates
   6. Communications equipment room(s)
   7. Communications cabling, including horizontal and backbone cabling
   8. Communications cabling cross-connects
   9. Communications backboards

B. The labeling schema used for structured cabling shall be an ANSI/TIA/EIA-606 compliant system - The Administrative Standard for the Telecommunications Infrastructure of Commercial Building Identification System. See Related Drawings for graphical representation.

C. Each communications room shall be equipped with a set of unique Key Drawings that shall identify the installed location of communications devices served out of and interconnected to the communications room. The drawings shall include identifiers that

uniquely associated field devices with specific termination products within the Communications room.

1.4 SUBMITTALS

A. General
   1. Product Data and Shop Drawing submittals for work of this section shall be SUBMITTED TOGETHER, complete, as a single submittal.

B. Product Data
   1. Manufacture datasheets for all products.

C. Shop Drawings
   1. Labeling system diagram, detailed.
   2. Communications room wall elevation drawings indicated the size, title and location of all Key Drawings.

D. Communications Room Key Drawings
   1. (2) full size copies of the Communications Room Key Drawings
      a. These drawings should be submitted for review by the Designer with or prior to the pre-acceptance submittal.

E. Closeout Submittals
   1. A diagram of the labeling schema used on the Project.
   2. Copies of Communications Room Key Drawings

PART 2 - PRODUCTS

2.1 GENERAL

A. All products used for labeling and identification of communications systems shall be reviewed and approved by the Designer prior to installation.

2.2 MANUFACTURERS

A. Products from the following manufacturers may be used on this project:
   1. Panduit
   2. Hellerman/Tyton
   3. Brother
   4. Thomas and Betts

2.3 LABELS

A. Cable Labels
   1. Cable labels shall permanent, self laminating type.
   2. Labels shall have a white background for text, and bold black nomenclature.

3. Provide alphanumeric, clearly typewritten labels at all designated points as follows:
    a. Horizontal Cables
        1) 4 pair UTP cables
            a) Basis of Design: Brady PTL-31-642
        2) 4 pair STP cables
            a) Basis of Design: Brady PTL-21-642
        3) Coaxial cables
            a) Basis of Design: Brady PTL-31-642
    b. Backbone cables
        1) 100 pair Copper cables
            a) Basis of Design: Brady PTL-34-642
        2) Fiber Optic Cables
            a) Basis of Design: Brady PTL-21-642
        3) Cable Bundles
            a) Basis of Design: Brady PTL-12-109

B. Miscellaneous Product Labels
1. Telecommunications outlet port
    a. Basis of Design: Panduit PLL-46-Y2-1
2. Telecommunications outlet faceplate
    a. Basis of Design: Panduit JLEFPS-1
3. Patch panel ports
    a. Basis of Design: Panduit JLCPL-1
4. Patch Panels
    a. Basis of Design: Brady PTL-20-422
5. 110 style blocks
    a. Basis of Design: Panduit DSL-110
    b. Use with Panduit P110LH
6. Communications Backboards
    a. Basis of Design: Brady PTL-37-422
7. Racks and Cabinets
    a. Basis of Design: Brady PTL-42-422

2.4 KEY DRAWINGS
1. Key drawings shall be professional produced by the Contractor.
2. Drawings shall be produced to include floor plans drawing to scale, typically at 1/8-inch = 1-foot, unless otherwise approved by the Designer.
3. Key drawing size shall be in direct proportion to the size of the space represented, but in not case larger than 24-inches by 36-inches.
4. Drawings shall be prepared on a 20lb bond paper substrate.
5. The key drawing information shall be produced in color. The color scheme shall be as follows.
    a. Paper background: White
    b. Floor plan layout: Light gray / faded black
    c. The colors of all drawing system associated with each system shall be unique.
6. Key Drawing Protective Overlay
    a. 1/8” Clear Plastic
    b. Size: 2-inches wider and 2-inches taller than the key drawings it protects.

c. Pre-drilled with mounting screw clearance holes
    1) Mounting holes shall be place 1/2-inch from the overlay edge and1/2-inch from the drawing the overlay protects.
    2) Mounting holes shall exist in each corner of the overlay
    3) Mounting holes shall exist along the vertical and horizontal edges, uniformly spaced no more than 18-inches on center.

7. Key drawings shall be prepared for each system and for each Communications room.
8. All key drawings shall have the same quality appearance. Colors, font type and properties shall be consistent and shall appear as though they were all prepared by the same professional organization.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Labels

1. General
    a. Apply all labels so that they are installed parallel to the dominant visual lines of the product being labeled.
    b. Labels shall be clearly legible and appropriately sized for the application.
2. Cable Labels
    a. Horizontal structured cabling:
        1) Cabling to ER/TR from outlets and devices
            a) ER/TR # - Patch Panel #/Port # - Outlet Room Number.
            b) Example: ER01-211-B22 where Equipment Room is identified as ER01, the cable travels to room 211 and the cable is landed on patch panel B position 22 (of 48) in the ER.
            c) Locate label on cable jacket between 3 and 6 inches of each end of the cable.
        2) Cabling between horizontal outlets/devices
            a) Label local input cables.
            b) Locate label on cable jacket between 3 and 6 inches of each end of the cable.
            c) Label each cable as to its signal type, purpose, and destination. Add a numeric suffix to uniquely identify multiple cables of duplicate signal type, purpose or destination.
3. Miscellaneous Product Labels
    a. Telecommunications outlet ports and faceplates:
        1) ER/TR# - Outlet Room Number – Patch panel #/ Jack #.
        2) Example: ER01-211 faceplate number and B22 through B25 jack numbers for a 4 port faceplate where Equipment Room is identified as ER01, the cable is landed on patch panel B position 22 through 25 (of 48) in the ER and travels to room 211.
        3) Locate the faceplate label, excluding the jack designation at the top of the faceplate. Locate the individual jack designation numbers immediately above each jack on the faceplate.
    b. Patch panels and patch panel ports:

1) Label each patch panel A-Z, top-to-bottom
   a) Locate label on the front upper left corner of all patch panels
2) Locate on the front of all patch panels, directly above or below (as indicated by the manufacturer) each jack position (1 through 48) in the patch panel; place the room number corresponding to the room number used on the faceplate for each port.
3) Labeling shall be in numerical order and correspond to the telecommunications outlet faceplate schema.

c. Backbone cabling:
1) Service designation – ER#/TR#.
2) Service designation – CB = Copper Backbone, FB = Fiber
3) Backbone, VB = Video Backbone. Example: CB – ER01/TR02.
4) Locate label on cable jacket within 6 inches of each end of the cable and at key pull points along pathway.

d. Cross-connect blocks, 110 style
1) Locate on the front of all blocks directly above or below (as indicated by the manufacturer) each position in the block.
2) Labeling shall be in numerical order and correspond to the telecommunications outlet faceplate scheme or opposite end labeling dependant on use.
3) Label the upper left corner of each block designating the service of that particular block. Do not terminate mixed services on the same block.

e. Cross-connect blocks, 66 style
1) Locate on the front of all blocks directly above or below (as indicated by the manufacturer) each position in the block.
2) Labeling shall be in numerical order and correspond to the telecommunications outlet faceplate scheme or opposite end labeling dependant on use.
3) Label the upper left corner of each block designating the service of that particular block. Do not terminate mixed services on the same block.

f. Communications Backboards (TBB)
1) Backboard # with the prefix TBB, followed by the numeric backboard number in the room, followed by the suffix identifying the room in which the backboard is located. Example: TBB–01-ER-xxx.
2) Label each 4’x8’ sheet and each partial sheet, in numerical order left-to-right as facing the front of the backboards.

g. Equipment Racks
1) Device ID. Example: ER01.02.
2) Label each cabinet/rack in numerical order left-to-right as facing front of cabinet/rack bays.

h. Telephone Patch Cables
1) Labeled with the same unique identifier at both ends of the assembly.

B. Key Drawings
1. Install Key drawings within each Communications room.
2. Create and install separate drawings, for each system. Voice and data systems may occupy the same key drawing.

3. Install key drawings where they will be readily accessible, visible and legible by Owner personnel.
    a. Normally, drawings shall be installed so that the top edge of the drawing(s) is at 72-inches above finished floor. If this height is not achievable the Contractor shall make recommendations to and seek the direction of the Designer.
4. Separate Key Drawings shall be prepared for each system, including but not limited to:
    a. Voice (Telephone) and Data (Network) communication systems RF Broadband Video Distribution Systems (CATV/SMATV/MATV)
    b. Security Systems (Video Surveillance, AccessControl, Intrusion Detection, etc…)
    c. Other systems as specified in this Division.

3.2 TRAINING

A. Conduct a walk through of the project site and demonstrate the presence and location of all key labeling elements used.

B. Demonstrate the accuracy of these Key drawings to the Owner by having the Owner randomly select devices on the key drawings followed by this Contractor showing the physical location and coordinated labeling of the actual field devices.

C. Furnish handouts to all owner personnel attending training that clearly depicts the labeling schema used on the project.

END OF SECTION 27 05 53

SECTION 27 11 00

STRUCTURED CABLING SYSTEM

PART 1 - GENERAL

1.1 WORK INCLUDES

A. Copper Cabling

B. Work Area Outlets

1.2 DESCRIPTION OF WORK

A. The Structured Cabling System shall utilize a network of various cable types and configurations to support systems including, but not limited to, data and voice. Additional cable types may be required to meet various system requirements and shall be specified elsewhere. Changes in the quantity and/or types of cables required shall be documented and submitted to the Engineer for approval prior to installation.

B. Cables and terminations shall be provided and located as shown, and in the quantities indicated on the Drawings.

C. All cables and terminations shall be identified at all accessible locations, and at both ends. All cables shall terminate in an alphanumeric sequence at all termination locations as indicated in these Specifications.

D. All copper cable terminations shall comply with and be tested to the latest revisions of TIA/EIA 568 standards for Category CAT6 installations.

E. Available and unused pairs between the Equipment Room (ER) and Horizontal Cross Connect(s) (HC) shall terminate and shall be identified as spare at each location and shall carry a unique sequentially numeric identifier at both ends. Station cables shall terminate on one, two or three gang wall plates equipped as shown on the Drawings.

F. Structured Cabling System
   1. The Structured Cabling System shall be installed as indicated on the Drawings. The system shall consist of the cabling and hardware required to install a new intra-building backbone to the new telecommunications rooms, as well as to provide a new horizontal distribution system for voice and data communications as indicated on the Drawings.
   2. The Structured Cabling System shall consist of the following components:
      a. Work Area
         1) The Work Area consists of the Telecommunications Outlet (TO) terminated on the end of the horizontal cable and provides modular connectivity to a single point device. The Contractor shall provide the required connectivity in close proximity to the device.

2) Unless otherwise indicated on the Drawings, it shall be the responsibility of the Contractor to properly terminate cabling to their respective devices. All cabling shall be 100% tested by the Contractor to assure specified performance.

3. Horizontal Cabling
   a. The Horizontal Cabling connects the Work Area to the HC. Any exceptions to the design of this cabling as detailed on the Drawings must be stated in writing and proven incompatible, or in violation of local codes or standards. It is imperative that the Structured Cabling System be installed as designed to create a fully operational system without any restrictions, and to provide maximum flexibility for future use.
   b. All continuous pathways, such as conduit, cable tray, raceway, etc., required to support the cabling, shall be provided by the Contractor unless indicated otherwise in the Contract Documents.
   c. All non-continuous or non-rigid pathways, such as J-hooks, inner-duct, etc., required to support the cabling, shall be provided by the Contractor, unless indicated otherwise in the Contract Documents.
4. Cross Connect Hardware
   a. The Cross Connect Hardware shall link all of the subsystems together at the HC, Intermediate Cross Connect (IC), and/or the Main Cross Connect (MC) locations. The Cross Connect Hardware shall consist of termination blocks, patch panels, racks, labeling hardware, cross connect wire, and patch and equipment cables for providing circuit connections and identification. All components required for the cross connects and identification of this equipment shall be provided by the Contractor, and shall be electrically and performance compatible with the horizontal and backbone cabling to assure signal quality.
5. Administrative Documentation and Record Keeping
   a. All cable path and cross connect field-engineering changes and records required shall be provided by the Contractor, with cooperation from the Contractor and the other Technology Systems Contractors, and shall be subject to approval by the Engineer. In addition, all labeling for the cables, cross connect blocks, patch panels, outlets, etc. shall be provided and installed by the Contractor. The other Technology Systems Contractors shall be responsible for placing labels on the cables and equipment they provide, consistent with that of the other Technology Systems.

G. The Contractor shall furnish and install all conduit and backboxes. Coordinate exact requirements and refer to the Technology Drawings for additional information.

PART 2 - PRODUCTS

2.1 OUTLETS

A. Faceplates
   1. Contractor shall provide all faceplates, including blank faceplates.
   2. All Faceplates shall be available in single, duplex, triplex, quadplex, or sixplex arrangements in a single gang configuration.

3. Faceplates to be installed in systems furniture shall be compatible with the respective manufacturer's furniture. All faceplates installed in systems furniture shall be flush mount. Surface mount boxes shall not be permitted.
4. Contractor shall coordinate faceplate type and color with the A/E and Owner.
5. Approved manufacturers:
    a. CommScope Uniprise – Ultra Media Series
    b. Ortronics – TracJack Series
    c. Systimax – XL7 Solution

B. Category 6 outlets
1. Technology outlets shall consist of one, two or three gang outlet box faceplates equipped with 8-pin modular (RJ-45) jacks, utilizing EIA/TIA-T568B wiring. All outlet cabling shall terminate on IDC type termination blocks at their associated HC, unless otherwise indicated in the Contract Documents.
2. All Category 6 outlets shall meet or exceed Category 6 transmission requirements for connecting hardware, as specified in the most recent revisions of TIA/EIA 568, and related addenda, regarding the Commercial Building Telecommunications Cabling Standard, Horizontal Cable Section, and have readily available numeric test results from ETL for passive model testing and TOLLY for active model testing.
3. The Category 6 outlets shall be capable of being installed a modular patching faceplate, or as a modular Telecommunication Outlet (TO), supporting all current and future applications designed to run on Category 6 outlets.
4. The Category 6 outlets shall be capable of being installed at either a 45° or a 90° angle in any modular faceplate, frame, or surface mounted box provided by the approved manufacturer, avoiding the need for special faceplates.
5. The Category 6 outlets shall be capable of greater than 750 insertions and 200 terminations.
6. Approved manufacturers:
    a. CommScope Uniprise – UNJ600
    b. Ortronics – Clarity
    c. Systimax – MGS400

2.2 HORIZONTAL DISTRIBUTION CABLE

A. Category 6 UTP, 4 Pair
1. Category 6 UTP, 4 Pair Horizontal Distribution Cables shall extend between the station location and the associated HC shall consist of 4 pair, 23 AWG, UTP, and shall terminate all conductors onto an 8-pin modular jack provided at each outlet.
2. Cable jacket shall comply with Article 800 of the NEC for use as a plenum cable as required by these Specifications. The 4 pair UTP cable shall be UL Listed Type CMP (plenum).
3. For CMP (plenum) rated cable, the cable jacket and the insulation of all individual conductors shall be of plenum rated materials.
4. The Category 6 UTP cable shall be a round design and shall support all current and future applications designed to run on Category 6 cabling.
5. The color of the voice and data cables shall be blue.
6. Approved manufacturers:
    a. CommScope - Ultra Media
    b. Systimax – X071

2.3 UTP PATCH CABLES AND WORK AREA CABLES

1. The same company manufacturing the connectors and patch panels supplied for the horizontal connectivity shall manufacture all UTP jumper cables.
2. The Contractor shall supply a quantity of patch cables equal to 150% of the horizontal cables terminated in each TR.
3. The Contractor shall supply a quantity of work area cables equal to 75% of the horizontal cables terminated at the work area TO.
4. Both patch cables and work area cables shall be divided evenly at 50% (2) meter, and 50% (3) meter, unless otherwise noted.
5. The Contractor shall coordinate with A/E and Owner for the color of the patch cables.

2.4 CROSS-CONNECTS

A. The Contractor shall provide all labor and materials for cross-connecting the backbone high-pair copper cabling between 110 wiring blocks and between 110 wiring blocks and patch panels. For horizontal to backbone cross-connects, provide one cross-connect for every voice jack in the system.

B. Cross-connect wire shall be 1-pair, 24 AWG+ solid bare annealed copper, flame-retardant semirigid PVC, and Category 3 compatible.

2.5 110 TYPE WIRING BLOCKS

A. The 110 wiring blocks shall support Category 3 and Category 5E applications, and facilitate cross connection and interconnection using either cross connect wire (voice only) or the appropriate Category patch cords.

B. The wiring blocks shall be fire retardant, molded plastic consisting of horizontal index strips for terminating 25 pairs of conductors each. These index strips shall be marked with five colors on the high teeth, separating the tip and ring of each pair, to establish pair location. A series of fanning strips shall be located on each side of the block for dressing the cable pairs terminated on the adjacent index strips.

C. The wiring block shall accommodate 22 through 26 AWG conductors and shall be able to mount directly on wall surfaces with or without backboards or on a 24” free-standing frame.

D. Clear label holders with the appropriate colored designation strips shall be provided with the wiring blocks. The insert label shall contain vertical lines spaced on the basis of circuit size (3, 4, or 5 pair) and shall not interfere with running, tracing or removing jumper wire/patch cords.

E. The wiring blocks shall be available in 100, and 300 pair sizes. The wiring blocks shall be available with or without legs. The legs shall allow the cables to pass behind the wiring block and fan out each side. The space created by the feet, on each side of the block, shall allow it to be used as a vertical jumper trough.

F. The wiring blocks shall capable of mounting to a wall frame or equipment rack.

G. The wiring block shall be able to accommodate over 500 repeated insertions without incurring permanent deformation and it shall pass the reliability test of no more than one contact failure in 10,000 connections.

H. Provide 110 type connecting blocks configuring for 5-pair terminations. Provide sufficient quantity to fully populate each wiring block. Connecting blocks shall be of the same manufacturer as the wiring blocks.

I. Approved manufacturers
   1. CommScope Uniprise – UN-110-WB Series
   2. Systimax - 100AW2 Series
   3. Ortronics - OR-110ABC5E Series

2.6 POWER STRIPS

A. Contractor shall provide two (2) standard EIA 19" rack mountable power strips per each rack designated as serving active network electronic equipment, whether network electronic equipment is designated as provided by the Contractor, unless otherwise noted.

B. The front panel shall have a digital current display, a lighted or embossed on/off switch, and a 20amp circuit breaker, and the rear panel shall have a minimum of eight (8) 5-20R receptacles.

C. The power strip shall use one rack space (1U), and have a minimum ten-foot (10') power cord. Coordinate plug type with the Owner.

D. All power strips shall provide a minimum of 450 joules surge suppression.

E. All power strips shall meet UL 1449 Standard for Surge Protective Devices.

F. Approved manufacturers:
   1. Chatsworth
   2. Geist
   3. TrippLite

PART 3 - EXECUTION

3.1 INSTALLATION

A. Cable Routing
   1. Where the Contractor is required to install non-continuous pathways for the Structured Cabling System, the Contractor shall keep hallway crossover to a minimum. Furthermore, non-continuous pathways shall be routed so as to follow logical paths parallel and perpendicular to the building structure. Diagonal pathways are prohibited, unless absolutely unavoidable, and approved by the Engineer.

2. Where duct, cable trays or conduit are not available, the Contractor shall bundle, in bundles of 50 or less, horizontal distribution wiring with Mille-ties or Velcro snug, but not deforming the cable geometry. Where cable bundles are to be supported by J-hooks, the J-hooks shall be attached to the building structure and framework per local codes and regulations at a maximum of five (5) foot intervals.
3. Cable ties and other methods of binding cabling shall not be installed in such a fashion to as to bend, crimp or deform the cabling in any way so as to alter the electrical or transmission characteristics of the cabling.
4. Plenum rated Mille-ties or Velcro shall be used in all appropriate areas.
5. All horizontal cables, regardless of media type, shall not exceed 90 m (295 ft) from the Telecommunications Outlets in the Work Area to the Horizontal Cross Connect.
6. The combined length of jumpers, or patch cords and equipment cables in the Telecommunications Space and the Work Area shall not exceed 10m (33 ft) unless used in conjunction with a multi-user Telecommunications Outlet.
7. A "ring-run" shall be provided at the MDF to keep multi-pair cables organized. The "ring-run" shall be constructed of 4-inch wide aluminum, "D" rings screw mounted. A "ring-run" shall also be provided in each IDF.
8. Horizontal pathways shall be installed such that the minimum bending radius of the horizontal cables is kept within manufacturer specifications both during and after installation.
9. Telecommunications Pathways, spaces and metallic raceways, which run parallel with electric power or lighting cables or conduits, which is less than or equal to 480 Vrms, shall be installed with a minimum clearance of 50 mm (2 inches).
10. The installation of cabling shall maintain a minimum clearance of 3 m (10 ft) from power cables or conduits in excess of 480 Vrms.
11. No telecommunications cross connects shall be physically located within 6 m (20 ft) of electrical distribution panels, or step down transformers, which carry voltages in excess of 480 Vrms.
12. Each run of UTP/ScTP cable between the cross connect in the Telecommunications Room and the Telecommunications Outlet shall be continuous. Splicing of any cable is prohibited.
13. The Contractor shall provide all devices for routing the cabling as indicated on the Drawings, and as required by the manufacturer of the Structured Cabling System, so as to maintain the long-term health and operability of the Structured Cabling System.
14. Continuous conduit runs installed by the Contractor shall not exceed 30.5 m (100 ft) or contain more than two (2) 90-degree bends without utilizing appropriately sized pull boxes, unless otherwise indicated in these Specifications or on the Drawings.
15. The Contractor shall verify the proper installation technique and sizing of the raceway system prior to installation of the cabling.
16. All horizontal pathways shall be designed, installed and grounded to meet applicable local and national codes.
17. The number of horizontal cables placed in a cable support or pathway shall be limited to a number of cables that will not affect the geometric shape of the cables.
18. Maximum conduit pathway capacity shall not exceed a 40% fill with the exception of perimeter and furniture fill, which is limited to 60% fill for moves, adds and changes, unless otherwise noted on Drawings.

19. Horizontal distribution cables shall not be exposed in the Work Area or other locations with public access, unless otherwise noted on Drawings.
20. Cables routed in a suspended ceiling shall not be draped across the ceiling tiles. Ceiling grid wires shall not be used for attaching cable support supports. Cable supports shall be mounted along walls a minimum of 75 mm (3 inches) above the ceiling grid supporting the tiles.
21. Each cable shall be run in a homerun configuration, and shall contain no bridges, taps or splices, except where required specifically by the manufacturer of a technology system, utilizing a dedicated cable run.
22. Cabling shall not be attached to any mechanical, electrical or technology system other than those specifically noted in the Contract Documents.
23. Cabling shall maintain clearance from Line Voltage cabling and devices at all times, and shall be spaced from these devices so as to comply with the TDMM, the NEC, and any other local codes or regulations.

B. Pulling Tension
1. The maximum pulling tension for all cables shall not exceed the respective manufacturer's specifications, or the limits as published in current edition of the TDMM.

C. Bending Radius
1. The Contractor shall adhere to the manufacturer's requirements and as indicated in the BICSI Telecommunications Distribution Methods Manual (TDMM) for bending radius and pulling tension of all data and voice cables. Where the manufacturer's specifications differ from those cited in the TDMM, the Contractor shall abide by the greater bending radius and the lesser pulling tension.
2. The minimum bending radius for any cable shall not exceed the respective manufacturer's specifications.
3. In spaces with UTP/ScTP cable terminations, the bending radius for all 4-pair cables shall not exceed four times (4x) the outside diameter of the cable and ten times (10x) the outside diameter of a multi-pair cable, unless this violates the manufacturer's specifications.
4. During the actual installation, the bending radius of a 4 pair cable shall not exceed eight times (8x) the outside diameter of the cable and ten times (10x) the outside diameter of a multi-pair cable, unless this violates the manufacturer's specifications.

D. Slack
1. In the Work Area, a minimum of 300 mm (12 inches) shall be left for UTP/ScTP.
2. In Telecommunications Spaces a minimum of 3 m (10 ft) of slack shall be left for all copper cabling. This slack shall be neatly managed on trays or other support types.

E. Special Requirements for Cable Routing and Installation
1. All cabling used throughout this project shall comply with the requirements as outlined in the National Electrical Code Articles 725, 760, 770, and 800 and the appropriate local codes. All copper cabling shall bear minimum CMP (plenum rated) and/or appropriate markings for the environment in which they are installed.

2. The Contractor shall be responsible for the determination of the necessity of limited combustible, plenum rated cabling, and shall be aware of any local codes regarding the use of these cable types.
3. Cables shall not be attached to or supported by fire sprinkler heads or delivery systems or any environmental sensor located in the ceiling space.

F. Grounding
1. Horizontal cable shall be grounded in compliance with ANSI/NFPA 70 and local requirements and practices. Horizontal equipment includes but is not limited to cross connect frames, patch panels and racks, cable runway, active telecommunications equipment, and test apparatus and equipment.
2. The Contractor shall bond all non-current carrying equipment provided by the Contractor including, but not limited to cable runways, racks, wall fields, protection devices, etc., to the TMGB.
3. The bonding conductor used to bond the horizontal cable equipment to the TGB shall be a minimum of 6 AWG, stranded, jacketed, copper wire. The color of the jacket shall be green.
4. Paint piercing grounding washers and antioxidant shall be used when attaching ground lugs to equipment racks and enclosures.

3.2 STRUCTURED CABLING SYSTEM TESTING

A. General
1. The Engineer retains the right to be present at any or all cable certification. The Contractor shall provide written notice 48 hours prior to the beginning of the certification process.
2. The Contractor shall provide a copy of the unaltered certification test reports to the A/E and Owner in both hardcopy and electronic (softcopy) format. The Contractor shall also provide a copy of the associated Cable Tester's Database Management Software with unedited soft copy. The Contractor shall provide the electronic (softcopy) test results in the respective tester's original format, e.g., if a WireScope tester is used, then the softcopy shall be in Scope Data Pro format.
3. The A/E and Owner reserves the right to mandate re-termination or other reasonable rework to improve the performance of any cabling indicated as being a "marginal pass".

B. Copper Cabling
1. Upon completion of the cable installation, the Contractor shall perform complete copper cable certification tests on every cable, including but not limited to:
    a. For Category 3 Cabling and higher:
        1) Wire Map
        2) Length
        3) Attenuation
        4) Near End Cross Talk (NEXT)
    b. For Category 5E and higher, additional tests shall be:
        1) Equal Level Far End Cross Talk (ELFEXT)
        2) Propagation Delay and Delay Skew
        3) Return Loss
    c. For Category 6 and higher, additional tests shall be:
        1) Power Sum Cross Talk (PSNEXT and PSELFEXT)

2) Insertion Loss
3) Attenuation to Cross Talk (ACR
4) Power Sum Attenuation to Cross Talk (PSACR)
5) Power Sum Equal Level Far End Cross Talk (PSELFEXT)

2. Tests shall be performed to published standards, including but not limited to, the latest revisions of EIA/TIA 568, ISO/IEC 11802 and other applicable standards at the time of installation.
3. All tests shall be performed with a certified Level IV UTP/ScTP test device. The preferred test instrument is the WireScope PRO.
4. All UTP/ScTP field test instruments shall be factory calibrated at a frequency required by the field test equipment manufacturer as stipulated by the manuals provided with the field test unit. The calibration certificate shall be provided to the A/E and Owner for review prior to the start of testing.
5. New test leads and/or calibration of testing instruments shall be provided at the beginning of each project.
6. Autotest settings provided in the field tester for testing the installed cabling shall be set to the default parameters.
7. Test settings from options provided in the field testers shall be compatible with the installed cable under test.
8. All proposed Category 6 channels are qualified for linear transmission performance up to 100 MHz to ensure that high frequency voltage phase and magnitude contributions do not prove cumulative or adversely affect channel performance.
9. All proposed Category 6 channels are qualified for linear transmission performance up to 250 MHz to ensure that high frequency voltage phase and magnitude contributions do not prove cumulative or adversely affect channel performance.
10. Category 3, UTP/ScTP horizontal and backbone cables, whose length does not exceed 90 m (295 ft) for the permanent link, and 100 m (328 ft) for the channel shall be 100 percent tested according to the latest revisions of ANSI/TIA/EIA-568, and all appropriate addenda. Test parameters include wire map plus ScTP shield continuity (when present), attenuation, length, NEXT (Near end crosstalk loss). NEXT testing shall be done in both directions.
11. All UTP/ScTP backbone cables exceeding 90 m (295 ft) or 100 m (328 ft) shall be 100 percent tested for continuity if applications assurance is not required.
12. Category 6 or higher, UTP/ScTP horizontal and backbone cables for the basic link shall be 100 percent tested according to the latest revisions of ANSI/TIA/EIA-568, and all appropriate addenda. Test parameters include wire map plus ScTP shield continuity (when present), length, NEXT loss (pair-to-pair), NEXT loss (power sum), ELFEXT loss (pair-to-pair), ELFEXT loss (power sum), return Loss, attenuation, propagation delay, and delay skew.
13. Category 3 and 5E or higher category backbone cables, that exceed 90 m (295 ft) or 100 m (328 ft), but less than 800 m (2, 624 ft) or 815 m (2, 674 ft), and applications warranty is desired, shall have 100 percent of the cables tested according to ISO/IEC Class A, B, or C.

3.3 SUBMITTALS

A. Submittals shall include instructions for installation and maintenance, suitable for inclusion in the Operating and Maintenance Manuals.

B. Submittals shall include descriptive literature for all cabling system components, connections, connectors and a comprehensive bill of materials. Highlight the specific part numbers/descriptive text of the materials to be provided.

3.4 PERFORMANCE AND WARRANTY

A. The Contractor shall furnish and install all system cabling and components as required for a complete system as described elsewhere in these Specifications and as shown on the Drawings.

B. The Contractor shall guarantee all material and installation labor to be free from defects for a period of two (2) years from the date of formal written acceptance by the Owner.

C. An additional product warranty provided by individual manufacturers, such as a twenty (20) year Structured Cabling System product warranty, shall supersede the two (2) year guarantee.

3.5 RECORD DRAWINGS

A. The Contractor shall submit to the A/E and Owner as a condition of final payment and acceptance a single reproducible set of Record Drawings exactly as the System was installed with all outlet and horizontal and backbone cable numbers designated on the Drawings.

END OF SECTION 2711 00

SECTION 27 11 16

COMMUNICATION CABINETS, RACKS, FRAMES AND ENCLOSURES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Supply and installation of equipment racks, cabinets, frames, enclosures and related accessories.

1.2 DEFINITIONS

A. Where the term “Equipment Rack”, or “Rack”, in either it’s singular or plural form, as utilized within this specification(s) and on the drawings is intended to generically refer to products designed for and normally used to house and/or mount 19”, 23” and 25” E.I.A. standard “rack mounted” equipment. These “Racks” come in multiple forms, sizes, styles and finishes including but not limited to the following:
   1. Cabinet Types
   2. Open Frame/Relay Types
   3. In-Wall Types
   4. Wall Mounted Types
   5. Swinging Types
   6. Portable and Roll around Types
   7. ATA Types
   8. Miscellaneous specialty types

1.3 SUBMITTALS

A. General
   1. Product Data and Shop Drawing submittals for work of this section shall be SUBMITTED TOGETHER, complete, as a single submittal.

B. Product Data
   1. Complete Bill of Materials (BOM) List
      a. The BOM shall be organized (i.e. “sub-grouped”) by Device ID.
      b. Under each Device ID the Contractor shall enumerate the quantity, brand and model of every product to be supplied associated with each Device ID.
      c. The manufacturer’s name (Brand) and full model number shall be used. (Distributor and Contractor assigned names and model numbers are unacceptable).
      d. Adjacent to the Device ID the Contractor shall clearly indicate the following:
         1) The Rack Type (as identified within these specifications)
         2) The room name and number in which the rack is to be located.

3) The system(s) that the rack supports

2. Manufacturer Product Datasheet for each product.
   a. Product datasheets shall be manufacturer originals, or first generation printed versions of manufacturer's official electronic product sheets.
   b. Manufacture model shall be highlighted on each sheet.
   c. Datasheets shall be organized to match the order and organization of this section

C. Shop Drawings
1. ½" = 1'0" enlarged plans of each space that houses one or more equipment rack(s) and related accessory products. Seek the direction of the Designer if a scale other then this is necessary to make the plan(s) fit on the specified sizes of paper.
   a. Drawings shall be reproduced on 11" x 17" paper,
      1) Drawings shall be reinforced, folded and bound into the rear of the submittal binder.
      2) Each drawing shall reflect a single room.
   b. Drawings shall clearly reflect the unique Device ID assigned to the rack.
2. Full Scale drawings of the labels that will be affixed to each equipment racks.

D. Quality Assurance / Control Submittals
1. RCDD Certification for the staff member responsible for this project.
2. Resume of the last 10 projects of the RCDD responsible for this project
3. BICSI Technician's certificate for each lead Technician(s) on the project

E. Closeout Submittals
1. Communication Room enlarged Floorplan Layouts, drawing to scale, depicting device sizes and locations..
2. A diagram of the labeling scheme used on the Project.

1.4 DELIVERY, STORAGE AND HANDLING

A. This contractor shall coordinate the delivery location and timing of delivery of product to the project site and/or other contractor's pre-assembly site(s) as necessary to meet the needs of contractors utilizing product supplied under this section.

PART 2 - PRODUCTS

2.1 PRODUCTS

A. General
1. All racks shall be UL Listed for the location and manner in which the product will be installed and used.
2. All products furnished of a given type under this section shall be manufactured by a single manufacturer; shall bear the same brand name; shall be of the same finish color and texture; and shall be from the same product model series, unless otherwise noted.

3. Accessories furnished for use with an equipment rack shall be from the same manufacture as the rack, except where unless otherwise specified and/or indicated on the drawings
4. All equipment racks and their accessories shall be furnished black in color unless otherwise expressly identified herein or noted on the drawings.
5. All racks located adjacent to one another shall be matching in size, color, fit and finish texture, and shall be manufactured by the same manufacturer except where otherwise expressly required by the Designer.
6. All racks located within eye-sight of one another shall be matching in color, finish texture, and as manufactured by the same manufacture except where otherwise expressly required by the Designer.

B. Substitute Racks
1. Substitute equipment racks may not exceed the physical dimensions of the specified equipment racks, nor may they be less then ½ inches less in any external dimension without the model specific pre-bid written approval of the Designer.

C. Rack Side Panels
1. Where equipment racks require accessory side panels, and where these racks are detailed on the drawings to be “ganged” together, only one set of side panels is required to be furnished for each model of rack in the gang.

2.2 EQUIPMENT RACKS

A. Floor Type
1. Description
a. Frames: Modular units designed for telecommunications terminal support and coordinated with dimensions of units to be supported.
b. Material: Extruded aluminum.
c. Four-post: minimum 1000lbs load rating.
d. Overall height: as shown on drawings.
e. Depth: minimum 23 inches.
f. Rack units: as shown on drawings.
g. Finish: Manufacturer's standard, baked-polyester powder coat.
a) Color: Black.
h. Vertical and horizontal cable management channels, top and bottom cable troughs, grounding lug and power distribution units (PDU).
i. Base shall have a minimum of four mounting holes for permanent attachment to floor.
j. Top shall have provisions for attaching to cable tray or ceiling.
a) Self-leveling
k. Approved Manufacturer: Panduit.
l. Additional approved manufacturer(s): Great Lakes, Chatsworth, Hubbell.

2.3 RACK ACCESSORIES

A. Storage Drawer
1. Accessory key lock.

2. Sizes and quantity as indicated and/or scaled from drawings.

B. Filler Panels
   1. General
      a. Provide quantity of filler panels as required to filling all unused spaces of every supplied equipment rack not occupied by a supplied product specified in another section or as shown on the Detail Drawings.
      b. Except where shown on the drawings, all furnished filler panels shall not exceed 2-rack units (3.5 inches) in height.
      c. Provide appropriate mixture of vent-type and blank-type filler panels as required to ensure proper air-flow and equipment cooling.
   2. Vent-Type
      a. 16-Gauge steel construction
      b. Vertical vent slot orientation
      c. Textured powder coat finish
      d. Flanged upper and lower edges for rigidity.
   3. Blank-Type
      a. 16-Gauge steel construction
      b. Textured powder coat finish
      c. Flanged upper and lower edges for rigidity.

C. Rack Mount Shelves – (for use in Voice/Data/Network Racks only)
   1. Basis of Design: Homaco ESV-19-4B
   2. Sizes and quantity as indicated and/or scaled from drawings.

D. Rack Mounted Shelves – Custom (used for Audio, Video and Security Systems Equipment)
   1. 16-Gauge steel construction
   2. Textured powder coat finish
   3. Form-fitted front panel sized to exactly match the products hosted on the shelf
   4. Custom sized in standard EIA Rack unit heights to match the equipment hosted on the shelf.
   5. Quantity: Furnish quantity and size of custom shelves required to accommodate all equipment to be mounted that is neither supplied with nor available from the product manufacturer with a rack mount accessory kit.

E. Rack Mounting Screws
   1. Truss-type screw head
   2. Black finish
   3. Matching size and color nylon protective washer
   4. For Racks with #10-32 threaded rack rails
      a. #10-32 thread
         1) Furnish (3) Phillips-drive screw/per rack space/per supplied rack.
         2) Furnish (1) Square-post security drive screw/per rack space/per supplied rack.
   5. For Racks with #12-24 threaded rack rails
      a. #12-24 thread
         1) Furnish (4) Phillips-drive screw/per rack space/per supplied rack.

2.4 LABELS

A. Equipment Racks
   1. Label shall be white polyester.
   2. Label shall have temperature range of -40 to 248 degrees F
   3. Label shall have superior adhesion and utilize thermal transfer
   4. Label shall utilize ¾" black font
      a. Basis of Design: Brady PTL-100-483

PART 3 - EXECUTION

3.1 COORIDINATION

A. This Contractor shall coordinate closely with all Contractors/sub-contractors/vendors supplying work within supplied product. This coordination shall include review of equipment rack configurations to ensure that they appropriately complement the systems being supplied;

B. This Contractor shall coordinate the delivery of product and its installation to meet the workflow of contractors, sub-contractors and this project as a whole.

3.2 INSTALLATION

A. Equipment Racks
   1. General
      a. Secure all fixed position, non-portable equipment racks using removable threaded fasteners to prevent equipment racks from movement and tipping over.
      b. Bond all equipment racks to the Telecommunications System Ground.
      c. Properly secure racks to the floor allowing a minimum of 36-inches of clearance from the rear of the rack to the rear wall except where otherwise expressly dimensioned on drawings.
      d. Install rack doors and panels.
   2. Cabinet Types
      a. Install bushings or grommets to protect cables where exiting or entering the rack. Clean, prep and paint visible conduits using oil-based paint that exactly matches color of equipment rack.
   3. Open Frame/Relay Types
      a. Install bushings or grommets to protect cables where exiting or entering the rack. Clean, prep and paint visible conduits using oil-based paint that exactly matches color of equipment rack.
   4. Swinging Cabinet Types
      a. Furnish and install minimum of two (2) 3-inch conduits stubs from top of cabinet back pan to cable tray, ladder rack and/or accessible ceiling above for cabling. Provide additional quantities and sizes as indicated on drawings. Install insulated throat bushings to protect cables. Clean, prep and paint visible conduits using oil-based paint that exactly matches color of equipment rack.
   5. Wall Mounted Types

a. Furnish and install minimum of two (2) 3-inch conduits stubs from top of cabinet to cable tray, ladder rack and/or accessible ceiling above for cabling. Provide additional quantities and sizes as indicated on drawings. Install insulated throat bushings to protect cables. Clean, prep and paint visible conduits using oil-based paint that exactly matches color of equipment rack.

6. Portable Types; Racks with Casters
   a. Install insulated throat bushings to protect cables entering rack and other cable penetrations.

B. In-Ceiling Zone Cabling Enclosures
   1. In-ceiling consolidation points shall be designed to fit in 2'x2' drop-ceiling grid.
   2. Enclosure shall be supported from building structure above lay-in ceiling grid and be installed to manufacturer's instructions.
   3. Enclosure shall be capable of mounting at least 9 RU of equipment/panels.
   4. Basis of Design: Panduit CICZC2X2 with CICZCBRKT
      a. Additional approved manufacturers: American Access Technologies, Chatsworth Products

C. Rack Accessories
   1. Grounding Bus Bar
      a. Install grounding bus bars in each equipment rack
   2. Filler Panels
      a. Install the required size and type of filler panels in equipment racks.
      b. The size, location and ratio of blank–to-vent filler panels shall be as required to assure proper ventilation of equipment.
      c. Mount the filler panels within the rack using approved mounting hardware, ensuring that all unused spaces within the equipment rack are covered.
   3. Rack Lights
      a. Supply and mount service lights in the rear of all equipment racks.
      b. Where non-magnetic racks are supplied, supply and install Designer approved substitute fixture attachment hardware.
   4. Rack Drawers
      a. Furnish and install rack drawers as indicated on the drawings.
   5. Ventilation Products
      a. Furnish and install ventilation products as specified and indicated on the drawings. Test operation of all ventilation products and adjust as appropriate
   6. Cable Management Products

3.3 LABELING

A. Label all equipment racks in accordance with Division 27 – "Identification for Communications"

END OF SECTION 27 11 16

SECTION 27 11 23

COMMUNICATIONS CABLE MANAGEMENT AND LADDER RACK

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Supply and installation of complete and working cable management system(s) for use within communications rooms. Work includes, but is not necessarily limited to:
      a. Specialty cable management and support products used to dress, support, store and organize cables mounted to walls and ceilings.
      b. Horizontal and vertically oriented ladder rack used for support and management of cables.
      c. Horizontal and vertical cable management used within equipment racks.

1.2 SYSTEM DESCRIPTION

A. The cable management and ladder rack system shall accommodate the support and orderly routing and management of communications and related cabling with communication rooms.

B. The system shall consist of horizontal ladder rack used for support of cables that need to traverse horizontally overhead within the room.

C. The system shall consist of vertical ladder rack for support and dressing of cables that must traverse vertically from cable entry/exit points near the floor upwards towards the ceiling and/or to entry/exit points near the ceiling of the room.

D. The system shall consist of horizontal and vertical cable management products used to support and dress cables that land on products mounted to the walls and/or ceilings.

E. The system shall consist of horizontal and vertical cable management products used for management of communication cable products within an equipment rack

1.3 SUBMITTAL

A. General
   1. Product data and shop drawing submittals for work of this section shall be submitted together as a single submittal.

B. Product Data
   1. Bill of materials list
   2. Manufacture datasheets for all products and accessories

C. Shop Drawings
   1. Communication room enlarged floor plan(s) depicting all of the following:
      a. Sizes and locations of all ladder rack
      b. Sizes and locations of other cable management products
      c. Drawings shall be on 11x17 paper.
   2. Communication room(s) wall elevations depicting all of the following:
      a. Sizes and locations of all ladder rack
      b. Sizes and locations of other cable management products
      c. Drawings shall be on 11x17 paper.

D. Closeout Submittal
   1. Datasheets for all products used.
   2. Bill of materials list of products used in each communications room.
   3. Scaled and accurate as-built shop drawings.

PART 2 - PRODUCTS

2.1 COMPONENTS

A. Ladder Rack
   1. Horizontally mounted
      a. Constructed of 1 ½ inch by 3/8 inch ASTM A513 compliant tubular steel
      b. Black in color.
      c. Dimensions shall be 12 to 24 inches wide (as indicated on the drawings) with 9 to 12 inch spacing between cable support rungs.
      d. Horizontally installed ladder rack shall have 7-inch high posts spaced every two feet on center.
      e. Basis of Design: Chatsworth 10250-712
      f. Additional Approved Manufacturers: Homaco, PFT, B-Line/Saunders
   2. Vertically mounted
      a. Constructed of 1 ½ inch by 3/8 inch ASTM A513 compliant tubular steel
      b. White in color. (Matching white backboard)
      c. Ladder rack dimensions shall be 12 to 24 inches wide (as indicated on the drawings) with 9 to 12 inch spacing between cable support rungs.
      d. Basis of Design: Chatsworth 10250-212
      e. Additional Approved Manufacturers: Homaco, PFT, B-Line/Saunders
   3. Spillways, Waterfalls, Cable Drop-outs
      a. Basis of Design shall be Chatsworth 12100-xxx.
      b. Additional approved manufacturers: Cooper/B-Line, Hoffman, Homaco, Middle Atlantic

B. Voice/Data Rack Cable Management
   1. TYPE A (All Cable Management panels shall be of this type unless specifically noted as another type on the detail drawings.
      a. Cable Management panels shall provide station cable routing on the rear and both horizontal and vertical metal slotted rings, and plastic wire holding clips on the front.
      b. Basis of Design:
         1) 2 Rack Space units:

WIRE MGMT PANEL	**WM-A(2RU)**		
	Basis of Design	*Additional Approved Product*	*Additional Approved Product*
Manufacturer:	HOMACO	MIDDLE ATLANTIC	HUBBELL
H/W Inches:	3.5/19"	3.5/19"	3.5/19"
Panel	HFM-19-2	HCM-2DR	HC219GC36
Vert.Cable Mgmt Rings:	INCL	(2) D-RING	(2) HC23VR2
Front Cord Rings:	INCL	INCL	INCL
Rear Cable Channel		INCL	INCL

2) 1 Rack Space units:

WIRE MGMT PANEL	**WM-A(1RU)**		
	Basis of Design	*Additional Approved Product*	*Additional Approved Product*
Manufacturer:	HOMACO	MIDDLE ATLANTIC	HUBBELL
H/W Inches:	1.75/19"	1.75/19"	1.75/19"
Panel	HFM-19-1SR	HCM-1DR	HC119GC36
Vert.Cable Mgmt Rings:	INCL	(2) D-RING	(2) HC23VR2
Front Cord Rings:	INCL	INCL	INCL
Rear Cable Channel	INCL	INCL	INCL

2. TYPE B (Shall be used when mounting in a Cabling Cabinet with Vertical Management installed)
   a. Cable Management panels shall provide station cable routing on the rear and horizontal metal slotted rings, and plastic wire holding clips on the front.
   b. Basis of Design:
      1) 2 Rack Space units:

WIRE MGMT PANEL	**WM-B(2RU)**		
	Standard of Quality	*Additional Approved Product*	*Additional Approved Product*
Manufacturer:	HOMACO	MIDDLE ATLANTIC	HUBBELL
H/W Inches:	3.5/19"	3.5/19"	3.5/19"
Panel	HFM-19-2SRC	HCM-2DR	HC219GC36
Vert.Cable Mgmt Rings:	NONE	NONE	NONE
Front Cord Rings:	INCL	INCL	INCL
Rear Cable Channel	INCL	INCL	INCL

2) 1 Rack Space units:

WIRE MGMT PANEL	**WM-B(1RU)**		
	Standard of Quality	*Additional Approved Product*	*Additional Approved Product*
Manufacturer:	HOMACO	MIDDLE ATLANTIC	HUBBELL
H/W Inches:	1.75/19"	1.75/19"	1.75/19"
Panel	HFM-19-1SRC	HCM-1DR	HC119GC36
Vert.Cable Mgmt Rings:	NONE	NONE	NONE
Front Cord Rings:	INCL	INCL	INCL
Rear Cable Channel	INCL	INCL	INCL

C. Non-Voice/Data Rack Cable Management
   1. Horizontal Cable Lacing Bars
   2. Steel construction
   3. Baked on enamel finish
      a. Coordinate exact model(s) supplied with system supplier. Furnish LBR-1A when supplied rack is provided for future use.
   4. Additional Approved Manufacturers: Atlas-Sound, Lowell Manufacturing
   5. Quantity: Furnish (1) lacing bar for each 5-1/4" of vertical rack mounting space for each supplied equipment rack.

D. Vertical Cable Lacing Bars
   1. Steel construction
   2. Baked on enamel finish
   3. 2-inch wide
   4. Perforated design for easy mounting to rails within equipment racks and for securing cable tie wraps.
   5. Basis of Design: Middle Atlantic LACE Series.
      a. Coordinate exact models supplied with system supplier. Furnish LACE-P, sized to suit, when supplied rack is designated for future use.
   6. Quantity: Furnish minimum (4) lacing bar for each equipment rack supplied.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Ladder Rack
   1. Within Communication Rooms
      a. Within ER, TR, IDF, MDF communication rooms, ladder rack shall be installed to facilitate Cable Management within the space.
      b. Where related drawings indicate specific routing, size and location of ladder rack, install ladder rack as indicated in these drawings.

c. Where related drawings do not expressly depict ladder rack in communication rooms, supply and install ladder rack as follows:
    1) 12” horizontal ladder rack, minimum size, installed around the entire perimeter of the room. Install rack 12” below finished ceiling, but not less then 86” above finish floor. Install at a height that does not interfere with doors, windows and other equipment within the room.
    2) 12” horizontal ladder rack, minimum size, installed directly above and parallel to floor mounted equipment racks below. Ladder rack shall intersect and join the perimeter ladder rack.
    3) 12” vertical ladder rack, minimum size, installed on the wall at every floor and/or ceiling cable penetrations. Cable tray shall extend from the penetration to the perimeter cable tray.
    4) Furnish larger ladder rack sizes, as required, to accommodate all cables within the room.
    5) See “Horizontally Mounted” and “Vertically Mounted” installation guidelines for additional information.

2. Horizontally Mounted
    a. Install ladder rack using manufacturer recommended hardware and accessories including, but not limited to: splice extension clamps; horizontal tee splice kits; corner support kits; adjustable vertical bend kits; adjustable vertical splice kits; runway support kits designed for ceiling
    b. support from all threaded rod; runway drop-out at equipment racks; runway end caps; etc.
    c. Install waterfall fittings in every location where cable is intended to exit the ladder rack downward, at the end of a run as well as between the rungs.
    d. Support with threaded rod and U-channel supports systems.
    e. Ladder rack shall be installed approximately 96” A.F.F, near the top of the backboards, unless otherwise noted on the drawings.
    f. Rack mounted with a side along a backboard, may mount with wall brackets; utilize threaded rod and manufacturer’s bracket kits for suspension of all remaining ladder rack sections.
    g. Install as a complete system in accordance with manufacturer’s written installation instructions as indicated on the Drawings and to ensure electrical continuity of the system and adequate support for the cabling. Provide all manufacturer’s recommended fittings and accessories.
    h. Provide support for the ladder rack at a minimum of 4’ 6” on center and at all splices, tees, elbows, bends, intersections, and transitions.
        1) Support with threaded rod and U-channel supports systems
            a) 12” width – ½” ATR; 24” width – 5/8” ATR
        2) Rod lengths over 6’ will require a “Rod Stiffener” installation.
            a) A section of U-Channel stock is placed around the rod and stiffener clamp assemblies used to clamp to rod
            b) Place clamps a minimum of 6” from the top and bottom of the rod and every 18” in between.
    i. Install the ladder rack system free of all sharp edges, burrs or projections that could harm cables or humans.
    j. Provide side posts at 2’ on center to both sides of the rack lengths.
    k. Provide end caps as specified.
    l. Install “waterfall” type protection for cable exit downward between rungs. l. Paint fittings as required to maintain aesthetic integrity of the installation.

m. The ladder rack shall be ceiling supported with wall bracing at rack ends.

3. Vertically Mounted
   a. Ladder rack rails shall mount flush against the backboard with rungs out.
   b. Mount flat to backboard with wall mount clamps.
   c. Rack mounted with one end on the floor and extending to intersecting cable tray/ladder rack used for horizontal cable delivery.
   d. Install as a complete system in accordance with manufacturer's written installation instructions as indicated on the Drawings and to ensure electrical continuity of the system and adequate support for the cabling. Provide all manufacturer's recommended fittings and accessories.
   e. Provide support for the ladder rack at a minimum of 3' on center up the entire length.
   f. Install system free of all sharp edges, burrs or projections.
   g. Ground and bond the system in accordance with the NEC and ANSI/TIA/EIA 607.
   h. Provide end caps on all exposed ladder rack ends.
   i. Trim out rectangular slot of appropriate size in ceilings, where applicable, to enable cable passage to above ceiling lines.
   j. Paint fittings to maintain aesthetic integrity of the installation.
4. Spillways, Waterfalls, Cable Drop-outs
   a. Shall mount securely to ladder rack rails and shall maintain minimum bend radius on all cables entering or exiting the ladder rack.
   b. Install cabling exits a conduit sleeve, cable tray, or ladder rack and the cable(s) will be unsupported for more than six inches.

B. Rack Mount Cable Management
   1. All cable management panels shall be securely attached with recommended screws.
   2. Install panels in positions indicated on related drawings.
   3. Perform final coordination with other specification systems prior to installation.

END OF SECTION 27 11 23

SECTION 27 11 26

COMMUNICATIONS RACK MOUNTED POWER PROTECTION AND POWER STRIPS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Supply and installation of uninterruptible power supplies for communications equipment.
   2. Supply and installation of AC power distribution products for communications equipment.

1.2 SYSTEM DESCRIPTION / DESCRIPTION OF WORK

A. Equipment racks, cabinets, frames and enclosures shall be provided with

B. Uninterruptible Power Supplies (UPS) as indicated on the drawings.

C. UPS shall be installed in all other locations as identified in this section and on the drawings.

D. UPS shall supply power to equipment with the associated rack, cabinet, frame or enclosure in the event of any input power loss to the UPS.

E. Power distribution systems shall be provided within all equipment racks, cabinets, frames and enclosures and shall be sufficient to deliver to all equipment contained within them.

F. Power distribution products shall be provided on all communication backboards as indicated on the drawings and as additionally required to distribute power to all products mounted to the communications backboards.

G. 20% minimum, unused spare AC power receptacles shall be provided in all equipment racks, cabinets, frames and enclosures. This spare capacity shall be remain for owner use after all specified and pre-designated future systems are installed.

1.3 SUBMITTALS

A. Product Data
   1. Manufacture datasheets for all system equipment
   2. Complete BOM list
      a. BOM shall include the following information for each product:
         1) Contractor's quantity estimates.

2) Manufacturer name.
3) Manufacturer model number (as it appears on manufacturer's product data sheet).
4) Manufacturer product description.
5) Paragraph number of this section where the product is specified.

B. Shop Drawings
1. Power Distribution Block Diagrams(s)
a. Drawings shall depict the specific power products and the exact AC power distribution configuration for each rack.
b. Separate power distribution diagrams shall be prepared and submitted for each rack, cabinet enclosure shall be presented on a separate drawing.
1) Where identical power distribution arrangements are being planned to be supplied for multiple racks a typical shall be supplied that clearly identifies every rack (by Device ID) that will be using that specific power distribution plan.

C. Quality Assurance
1. RCDD Certification for the staff member responsible for this project.
2. Resume of the last 10 projects of the RCDD responsible for this project
3. BICSI Technician's certificate for each lead Technician(s) on the project

D. Closeout Submittal
1. Power Distribution Block Diagram(s)
a. Drawings shall depict the specific power products and the exact AC power distribution configuration for each rack

1.4 DELIVERY, STORAGE AND HANDLING

A. Products of this section shall be furnished in timely manner to coordinate with work of other sections.

PART 2 - PRODUCTS

2.1 GENERAL

A. All AC power products furnished shall be UL Listed for the location and manner in which the product will be installed and used.

B. All products furnished of a given type under this section shall be manufactured by a single manufacturer; shall bear the same brand name; shall be of the same finish color and texture; and shall be from the same product model series unless otherwise noted and/or approved by the Designer.

2.2 UNINTERRUPTIBLE POWER SUPPLIES (UPS)

A. General

1. Unless otherwise noted on the drawings, all UPS units shall be manufacturer designed for rack mounting and shall be furnished with all mounting hardware.

B. 2kVA Size
1. True on-line double conversion.
2. Furnished with power management software.
3. 120VAC input and output.
4. 19” EIA rack mounting hardware
5. NEMA 5-20 plug
6. Four (4) NEMA 5-20 receptacles
7. Basis of Design: Liebert GXT3 Series
8. Additional approved manufacturer(s): APC

C. 3kVA Size
1. True on-line double conversion.
2. Furnish with power management software.
3. 208VAC input and output.
4. 19” EIA rack mounting hardware
5. NEMA L6-30 plug
6. 4 NEMA 5-15R Receptacles
7. One NEMA L5-30R Receptacle
8. Basis of Design: Liebert GXT3 Series
9. Additional approved manufacturer(s): APC

2.3 POWER DISTRIBUTION

A. General
1. Furnish receptacles of the amperage rating matching the power feed(s) to the rack.

B. Within Voice/Data Equipment Racks
1. 15A Vertical multi-outlet power strips (Use with 3KVA RM UPS)
a. 120VAC input
b. NEMA 5-15R receptacles (14 – 24 outlets)
c. 45 - 72 inch length
d. 9 foot power cord with Nema5-15P plug
e. Basis of Design: Middle Atlantic PD-1415C-NS and PB-5A brackets.
f. Additional approved manufacturers:
1) Great Lakes Case & Cabinet #7215
2) Hoffman # AP722415
2. 20A Vertical multi-outlet power strips (Use with 2KVA RM UPS or Floor Model and Power Distribution Panel within room.)
a. 120VAC input
b. NEMA 5-20R receptacles (14 - 24 outlets)
c. 49 - 72 inch length
d. 9 foot power cord with NEMA 5-20P plug
e. Basis of Design: Middle Atlantic PD-1220C-NS and PB-5A brackets.
f. Additional approved manufacturers:
1) Great Lakes Case & Cabinet #7215-20AR
2) Hoffman # AP722420

C. Within Sound Reinforcement and Audio-Video Systems equipment racks
   1. General
      a. Each rack shall be furnished with a complete and working AC power distribution system.
      b. System shall consist of a remotely controllable power sequencer and AC power outlets controlled by this sequencer.
      c. Refer to both Communication Technology and Electrical series drawings to determine the presence of isolated-ground circuits feeding the equipment rack(s). Provide isolated ground versions of power distribution products as required to match power supplied.
      d. Where rack is designated for future use and where no system is specified for the rack, furnish (2) discrete vertical receptacle strips, each strip containing at least one (1) AC receptacle for every 5-1/4" inches of rack mounting space within the equipment rack.
   2. Integrated Power Sequencing System
      a. Equipment racks with fewer then 12 products requiring AC power, and less then 12 amperes of continuous current draw shall be provided with an integrated power sequencing system plus supplemental power strips. This system shall consist of.
         1) Rack mounted power sequencer with integral AC receptacles
         2) Supplemental Vertical AC power strips.
      b. Rack Mounted Power Sequencer
         1) Rack Mounted
         2) Front panel power switch
         3) Low-voltage remote control input
         4) Low-voltage status output port
         5) 120VAC Input
         6) (6) Nema5-15R Duplex Receptacles
         7) Nema5-15P Input plug
         8) 15 amp current rating
         9) Basis of Design: Middle Atlantic PDS-615R
      c. Vertical Power Strips
         1) Furnish quantity of individual strips containing the quantity of receptacles required (plus 20% spares) to fit within the supplied equipment rack(s).
         2) Basis of Design: Middle-Atlantic PD-Series
   3. Modular Power Sequencing System
      a. Equipment racks with greater then 12 products requiring AC power or a continuous current draw of 12 amperes or more shall be furnished with a complete and working modular power sequencing system consisting of:
         1) Power Sequence controller
         2) 6-circuit capable, 6-duplex outlet modular power distribution strips.
         3) Supplemental vertical power strips adequate AC receptacles to accommodate all equipment in the equipment rack (plus 20% spare capacity).
      b. Power Sequence Controller
         1) Six (6) low voltage control outputs
         2) External remote control inputs
         3) Status output ports
         4) 19" EIA rack mountable
         5) 1 Rack unit high

6) Front panel power switch and status LEDs
7) Basis of Design: Middle-Atlantic USC-6R Universal Sequence
8) Controller
9) Additional approved manufacturers: Brand/Model specific pre-approval required.

c. Modular Vertical Raceway System
1) Raceway
a) 3-Module Modular Raceway
(A) Overall Length: 32 inches
(B) Basis of Design: Middle-Atlantic MPR-3
b) 6-Module Modular Raceway
(A) Overall Length: 56 inches
(B) Basis of Design: Middle-Atlantic MPR-6
c) 9-Module Modular Raceway
(A) Overall Length: 80 inches
(B) Basis of Design: Middle-Atlantic MPR-9
2) Power Modules
a) 20Amp – 120volt – Remote Controllable
(A) Nema5-20R Duplex Receptacle
(B) Basis of Design: Middle-Atlantic RM-20
b) 20Amp – 120volt – Remote Controllable – Isolated Ground
(A) Nema5-20R(IG) Duplex Receptacle
(B) Basis of Design: Middle-Atlantic RM-20IG
c) 15Amp – 120volt – Remote Controllable
(A) Nema5-15R Duplex Receptacle
(B) Basis of Design: Middle-Atlantic RM-15
d) 15Amp – 120volt – Remote Controllable – Isolated Ground
(A) Nema5-15R(IG) Duplex Receptacle
(B) Basis of Design: Middle-Atlantic RM-15IG
e) Blank Modules
(A) Basis of Design: Middle-Atlantic MPR-BL
3) Jumper Cables
a) Receptacle to receptacle power jumpers
b) 12, 24 and 72 inch length available
c) Connectorized at both ends to mate with receptacles
d) Basis of Design: Middle-Atlantic J series
e) Tail Cables
f) Basis of Design: Middle-Atlantic T series

4. Vertical Power Strips
a. Basis of Design: Middle-Atlantic PD-Series
b. Furnish quantity of individual strips containing the quantity of receptacles required (plus spares) to fit within the supplied equipment rack(s).

D. Within Public Address, Intercom, and Security System(s) Equipment Racks
1. General
a. Each rack shall be furnished with a complete and working internal power distribution system consisting of enough AC receptacles to accommodate all equipment to be housed within the equipment rack, plus a 20 percent spare outlet capacity.
b. Refer to both Communication Technology and Electrical drawings to determine the presence of isolated-ground circuits feeding the equipment

rack(s). Furnish isolated ground versions of power distribution products to match incoming power feed(s).

c. Where rack is designated for future use and where no system is specified for the rack, furnish (2) discrete vertical receptacle strips, each strip containing at least one (1) AC receptacle for every 5-1/4" inches of rack mounting space within the associated equipment rack.

2. Vertical Rack Power Strips
   a. Full Rack Length
   b. 120VAC operating voltage
   c. 20-Amp and 15-Amp capacity versions
   d. Standard and Isolated Ground versions
   e. Basis of Design: Middle Atlantic PD Series
   f. Additional Approved Manufacturers: Wiremold, Hammond
   g. Manufacturing, Tripplite
3. Rack Mount Receptacle Strips
   a. 20 Amp – Non-Isolated Ground Version
      1) 19" EIA Rack Mountable
      2) 1-3/4" High
      3) 20Amp Nema5-20P Plug
      4) 6' AC Power Cord
      5) Integral 20Amp Circuit Breaker
      6) Front Panel AC power switch
      7) No front panel receptacles
      8) Minimum of 6 rear-mounted Nema5-20R receptacles
      9) Basis of Design: Hammond Manufacturing 1589H6F1BKRR
   b. 15Amp – Non-Isolated Ground Version
      1) 19" EIA Rack Mountable
      2) 1-3/4" High
      3) 15Amp Nema5-15P Plug
      4) Receptacles rotated 90 degrees (i.e. perpendicular) to length receptacle strip
      5) 6' AC Power Cord
      6) Integral 15Amp Circuit Breaker
      7) Front Panel AC power switch
      8) No front panel receptacles
      9) Minimum of 6 rear-mounted Nema5-15R receptacles
      10) Basis of Design: Hammond Manufacturing 1583H6A1BKRA

E. Within all Other Equipment Racks
   1. Unless otherwise specified herein and/or shown and/or noted on the related drawings each supplied rack shall be provided, minimally, with the following:
      a. One (2) 15-Amp 120VAC Single-circuit vertical power receptacle strips.
      b. Receptacle strip shall contain at least (1) Nema5-15R AC power outlet for each 3-1/2" of vertical rack mounting space. For example: A 44-rack unit cabinet shall have at least 22 total AC outlets.
      c. One (1) 20Amp 120VAC Single-circuit horizontal AC rack-mount AC power receptacle strip. Receptacle strip shall contain (6) Nema5-20R AC power outlets.

PART 3 - EXECUTION

3.1 COORDINATION

A. This Contractor shall coordinate with all other Contractors and sub-contractor(s) supplying and installing equipment racks, cabinets, frames and enclosures as well as the contractors providing

3.2 INSTALLATION

A. General
   1. Secure all fixed position equipment racks using removable threaded fasteners to prevent equipment racks from movement and tipping over.

B. Uninterruptible Power Supplies and Power Distribution
   1. General
      a. Coordinate directly with each system/equipment supplier/contractor/sub-contractor prior to installation of UPS, sequential controllers and receptacle strips to coordinate the installed location of these products. Location of these products shall complement the location of all connected products.
   2. Uninterruptible Power Supplies (UPS)
      a. Plug UPS into un-switched AC power source.
      b. Rack-mount both the power supply(s) and their accessory batteries as applicable.
   3. Telecommunication Racks
      a. Mount receptacle strips vertically in the rear of a cabinet or on rear of open frame relay racks.
      b. When UPS products are present, connect receptacle strips into outlets located on the UPS.

3.3 POWER DISTRIBUTION DEVICES:

A. Provide specified plug-in outlet centers in each equipment rack or backboard.
   1. Plug-in outlet centers shall be securely mounted to the equipment rack utilizing
   2. Manufacturer's recommended hardware.
   3. Position to allow the Owner adequate access and avoid functionality conflicts with rack features (i.e. adjustable rails).

END OF SECTION 27 11 26

SECTION 28 13 00

ACCESS CONTROL

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Access control system control panel.
   2. Access control system network and security.

1.2 DEFINITIONS

A. CCTV: Closed-circuit television.

B. Credential: Data assigned to an entity and used to identify that entity.

C. Identifier: A credential card; keypad personal identification number; or code, biometric characteristic, or other unique identification entered as data into the entry-control database for the purpose of identifying an individual. Where this term is presented with an initial capital letter, this definition applies.

D. LAN: Local area network.

E. PDF: Portable Document Format. The file format used by the Acrobat document-exchange-system software from Adobe.

F. TCP/IP: Transport control protocol/Internet protocol incorporated into Microsoft Windows.

G. UPS: Uninterruptible power supply.

H. USB: Universal serial bus.

I. Wiegand: Patented magnetic principle that uses specially treated wires embedded in the credential card.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product indicated. Include rated capacities, operating characteristics, and furnished specialties and accessories. Reference each product to a location on Drawings..

B. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.

1. System labeling schedules, including electronic copy of labeling schedules that are part of the cable and asset identification system of the software specified in Parts 2 and 3.
2. Wiring Diagrams. For power, signal, and control wiring.

1.4 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For security system to include in emergency, operation, and maintenance manuals.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: An employer of workers trained and approved by manufacturer.

B. Source Limitations: Obtain central station, workstations, controllers, Identifier readers, and all software through one source from single manufacturer.

C. 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.

D. Comply with NFPA 70, "National Electrical Code."

E. Comply with UL294.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Central Station, Workstations, and Controllers:
1. Store in temperature- and humidity-controlled environment in original manufacturer's sealed containers. Maintain ambient temperature between 50 and 85 deg F (10 and 30 deg C), and not more than 80 percent relative humidity, noncondensing.
2. Open each container; verify contents against packing list; and file copy of packing list, complete with container identification, for inclusion in operation and maintenance data.
3. Mark packing list with the same designations assigned to materials and equipment for recording in the system labeling schedules that are generated by software specified in "Cable and Asset Management Software" Article.
4. Save original manufacturer's containers and packing materials and deliver as directed under provisions covering extra materials.

1.7 PROJECT CONDITIONS

A. Environmental Conditions: System shall be capable of withstanding the following environmental conditions without mechanical or electrical damage or degradation of operating capability:
1. Control Station: Rated for continuous operation in ambient conditions of 60 to 85 deg F and a relative humidity of 20 to 80 percent, noncondensing.

2. Indoor, Controlled Environment: NEMA 250, Type 1 enclosure. System components, except the central-station control unit, installed in temperature-controlled indoor environments shall be rated for continuous operation in ambient conditions of 36 to 122 deg F dry bulb and 20 to 90 percent relative humidity, noncondensing.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Provide products by the following:
   1. Brivo OnAir (matching Owner's other facilities)

2.2 DESCRIPTION

A. Security Access System: IP based access control and alarms, cloud based software.

2.3 OPERATION

A. Security access system shall use a single database for access-control and credential-creation functions.

B. Distributed Processing: A fully distributed processing system.
   1. Access-control information, including time, date, valid codes, access levels, and similar data, shall be downloaded to controllers so each controller can make access-control decisions.
   2. Intermediate controllers for access control are prohibited.
   3. In the event that communications with the central controller are lost, controllers shall automatically buffer event transactions until communications are restored.

C. Location:
   1. A single location shall support up to 30 card readers, 250,000 credentials, 60,000 events stored off-line.

D. System Network Requirements:
   1. System shall communicate via the building's Ethernet or Wi-Fi network.

E. Cloud based Central station shall provide operator interface, interaction, display, control, and dynamic and real-time monitoring. Central station shall control system networks to interconnect all system components, including workstations and field-installed controllers.

F. Field equipment shall include controllers, sensors, and controls.
   1. Controllers shall serve as an interface between the central station and sensors and controls.
   2. Data exchange between the central station and the controllers shall include down-line transmission of commands, software, and databases to controllers.

3. The up-line data exchange from the controller to the central station shall include status data such as intrusion alarms, status reports, and entry-control records.

G. Operator Interface:
1. System supports the placement of an icon representing an event that may be configured to change the status of multiple objects.

H. Operator Access Control:
1. Operator access to various functions and operations in the system Administration and Monitoring Client applications are based on the configuration of the operator's privilege. The system supports an unlimited number of privileges, where the same privilege can be assigned to multiple operators.

2.4 CONTROLLERS

A. Controllers: Intelligent peripheral control unit, complying with UL 294, that stores time, date, valid codes, access levels, and similar data downloaded from the central station or workstation for controlling its operation.

B. Battery Backup: Sealed, lead acid; sized to provide run time during a power outage of 24 hours.

C. Basis of design: Brivo ACS6008-E (main controller), ACS6000-EXP/DB(X4) (expansion chassis and boards)

2.5 CARD READERS AND KEYPADS

A. Card-Reader Power: Powered from its associated controller, including its standby power source, and shall not dissipate more than 5 W.

B. Response Time: Card reader shall respond to passage requests by generating a signal that is sent to the controller. Response time shall be 800 ms or less, from the time the card reader finishes reading the credential card until a response signal is generated.

C. Enclosure: Suitable for surface, semi-flush, pedestal, or weatherproof mounting. Mounting types shall additionally be suitable for installation in the following locations:
1. Indoors, controlled environment.
2. Indoors, uncontrolled environment.
3. Outdoors, with built-in heaters or other cold-weather equipment to extend the operating temperature range as needed for operation at the site.

D. Display: Digital visual indicator shall provide visible and audible status indications and user prompts. Indicate power on or off, whether user passage requests have been accepted or rejected, and whether the door is locked or unlocked.

E. Proximity Readers:
1. Active-detection proximity card readers shall provide power to compatible credential cards through magnetic induction and shall receive and decode a unique identification code number transmitted from the credential card.

2. The card reader shall read proximity cards in a range from direct contact to at least 6 inches (150 mm) from the reader.

F. Communication Protocol: Compatible with local processor.

G. Basis of design: HID Multi-class SE RP40.

2.6 DOOR INTERFACE

A. Electrified door hardware: Refer to Architectural Specifications and Drawings for Door Hardware schedules.

B. Door Contacts:
1. Magnetic contact with standard gap.
2. Recess mounting.
3. White or gray color.
4. Max switching voltage of 110VAC/100VDC.
5. Basis of Design: Tane Alarm Products STB-10.

C. Request-to-Exit:
1. PIR technology with DSP.
2. Integral 90dB piezo sounder controlled by access control system.
3. Basis of Design: Kantech T.REX-XL.

2.7 CABLES

A. Plenum-Type, TIA 232-F Cables:
1. Two pairs, No. 22 AWG, stranded (7x30) tinned copper conductors, plastic insulation, and individual aluminum-foil/polyester-tape shielded pairs with 100 percent shield coverage; plastic jacket.
2. Pairs are cabled on common axis with No. 24 AWG, stranded (7x32) tinned copper drain wire.
3. NFPA 70, Type CMP.
4. Flame Resistance: NFPA 262 flame test.

B. Plenum-Type, TIA 485-A Cables:
1. Two pairs, No. 22 AWG, stranded (7x30) tinned copper conductors, fluorinated-ethylene-propylene insulation, unshielded, and fluorinated-ethylene-propylene jacket.
2. NFPA 70, Type CMP.
3. Flame Resistance: NFPA 262 flame test.

C. Multiconductor, Plenum-Type, Reader and Wiegand Card Reader Cables:
1. Six conductors, No. 20 AWG, stranded (7x28) tinned copper conductors, fluorinated-ethylene-propylene insulation, overall aluminum-foil/polyester-tape shield with 100 percent shield coverage plus tinned copper braid shield with 85 percent shield coverage, and fluorinated-ethylene-propylene jacket.
2. NFPA 70, Type CMP.
3. Flame Resistance: NFPA 262 flame test.

D. Paired, Plenum-Type, Lock Cables:
   1. One pair, twisted, No. 16 AWG, stranded (19x29) tinned copper conductors, PVC insulation, unshielded, and PVC jacket.
   2. NFPA 70, Type CMP.
   3. Flame Resistance: NFPA 262 flame test.

E. Paired, Plenum-Type, Lock Cables:
   1. One pair, twisted, No. 18 AWG, stranded (19x30) tinned copper conductors, fluorinated-ethylene-propylene insulation, unshielded, and plastic jacket.
   2. NFPA 70, Type CMP.
   3. Flame Resistance: NFPA 262 flame test.

F. Paired, Plenum-Type, Input Cables:
   1. One pair, twisted, No. 22 AWG, stranded (7x30) tinned copper conductors, fluorinated-ethylene-propylene insulation, aluminum-foil/polyester-tape shield (foil side out), with No. 22 AWG drain wire, 100 percent shield coverage, and plastic jacket.
   2. NFPA 70, Type CMP.
   3. Flame Resistance: NFPA 262 flame test.

G. Paired, Plenum-Type, AC Transformer Cables:
   1. One pair, twisted, No. 18 AWG, stranded (19x30) tinned copper conductors, fluorinated-ethylene-propylene insulation, unshielded, and plastic jacket.
   2. NFPA 70, Type CMP.
   3. Flame Resistance: NFPA 262 flame test.

H. LAN Cabling:
   1. Comply with requirements in Division 27 Section "Structured Cabling Systems."
   2. NFPA 262.

2.8 TRANSFORMERS

A. NFPA 70, Class II control transformers, NRTL listed. Transformers for security access-control system shall not be shared with any other system.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine pathway elements intended for cables. Check raceways, cable trays, and other elements for compliance with space allocations, installation tolerances, hazards to cable installation, and other conditions affecting installation.

B. Examine roughing-in for LAN and control cable conduit systems to PCs, controllers, card readers, and other cable-connected devices to verify actual locations of conduit and back boxes before device installation.

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

3.2 PREPARATION

A. Comply with recommendations in SIA CP-01.

B. Comply with TIA/EIA 606-A, "Administration Standard for Commercial Telecommunications Infrastructure."

C. Obtain detailed Project planning forms from manufacturer of access-control system; develop custom forms to suit Project. Fill in all data available from Project plans and specifications and publish as Project planning documents for review and approval.
   1. Record setup data for control station and workstations.
   2. For each Location, record setup of controller features and access requirements.
   3. Propose start and stop times for time zones and holidays, and match up access levels for doors.
   4. Set up groups, facility codes, linking, and list inputs and outputs for each controller.
   5. Assign action message names and compose messages.
   6. Set up alarms. Establish interlocks between alarms, intruder detection, and video surveillance features.
   7. Prepare and install alarm graphic maps.
   8. Develop user-defined fields.
   9. Develop screen layout formats.
   10. Propose setups for guard tours and key control.
   11. Discuss badge layout options; design badges.
   12. Complete system diagnostics and operation verification.
   13. Prepare a specific plan for system testing, startup, and demonstration.
   14. Develop acceptance test concept and, on approval, develop specifics of the test.
   15. Develop cable and asset-management system details; input data from construction documents. Include system schematics and CAD Technical Drawings in electronic format.

D. In meetings with A/E and Owner, present Project planning documents and review, adjust, and prepare final setup documents. Use final documents to set up system software.

3.3 CABLING

A. Comply with NECA 1, "Good Workmanship in Electrical Construction."

B. Install cables and wiring according to requirements in Division 26 Section "Wires, Cables, and Connectors."

C. Wiring Method: Install wiring in raceway and cable tray except within consoles, cabinets, desks, and counters. Conceal raceway and wiring except in unfinished spaces.

D. Wiring Method: Install wiring in raceway and cable tray except within consoles, cabinets, desks, and counters and except in accessible ceiling spaces and in gypsum board partitions where unenclosed wiring method may be used. Use NRTL-listed

plenum cable in environmental airspaces, including plenum ceilings. Conceal raceway and cables except in unfinished spaces.

E. Install LAN cables using techniques, practices, and methods that are consistent with Category 6 rating of components and fiber-optic rating of components, and that ensure Category 6 performance of completed and linked signal paths, end to end.

F. Boxes and enclosures containing security-system components or cabling, and which are easily accessible to employees or to the public, shall be provided with a lock. Boxes above ceiling level in occupied areas of the building shall not be considered accessible. Junction boxes and small device enclosures below ceiling level and easily accessible to employees or the public shall be covered with a suitable cover plate and secured with tamperproof screws.

G. Install end-of-line resistors at the field device location and not at the controller or panel location.

3.4 CABLE APPLICATION

A. Comply with TIA 569-B, "Commercial Building Standard for Telecommunications Pathways and Spaces."

B. Cable application requirements are minimum requirements and shall be exceeded if recommended or required by manufacturer of system hardware.

C. TIA 232-F Cabling: Install at a maximum distance of 50 ft.

D. TIA 485-A Cabling: Install at a maximum distance of 4000 ft.

E. Card Readers and Keypads:
   1. Install number of conductor pairs recommended by manufacturer for the functions specified.
   2. Unless manufacturer recommends larger conductors, install No. 22 AWG wire if maximum distance from controller to the reader is 250 ft, and install No. 20 AWG wire if maximum distance is 500 ft.
   3. For greater distances, install "extender" or "repeater" modules recommended by manufacturer of the controller.
   4. Install minimum No. 18 AWG shielded cable to readers and keypads that draw 50 mA or more.

F. Install minimum No. 16 AWG cable from controller to electrically powered locks. Do not exceed 250 ft.

G. Install minimum No. 18 AWG ac power wire from transformer to controller, with a maximum distance of 25 ft.

3.5 GROUNDING

A. Comply with Division 27 Section "Grounding and Bonding for Communications."

B. Comply with IEEE 1100, "Recommended Practice for Power and Grounding Electronic Equipment."

C. Ground cable shields, drain conductors, and equipment to eliminate shock hazard and to minimize ground loops, common-mode returns, noise pickup, cross talk, and other impairments.

D. Bond shields and drain conductors to ground at only one point in each circuit.

E. Signal Ground:
   1. Terminal: Locate in each equipment room and wiring closet; isolate from power system and equipment grounding.

3.6 IDENTIFICATION

A. In addition to requirements in this article, comply with applicable requirements in Division 26 Section "Identification for Electrical Systems" and with TIA/EIA 606-A.

B. Label each terminal strip and screw terminal in each cabinet, rack, or panel.
   1. All wiring conductors connected to terminal strips shall be individually numbered, and each cable or wiring group being extended from a panel or cabinet to a building-mounted device shall be identified with the name and number of the particular device as shown.
   2. Each wire connected to building-mounted devices is not required to be numbered at the device if the color of the wire is consistent with the associated wire connected and numbered within the panel or cabinet.

C. At completion, cable and asset management software shall reflect as-built conditions.

3.7 SYSTEM SOFTWARE AND HARDWARE

A. Develop, install, and test software and hardware, and perform database tests for the complete and proper operation of systems involved. Assign software license to Owner.

3.8 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. LAN Cable Procedures: Inspect for physical damage and test each conductor signal path for continuity and shorts. Use Class 2, bidirectional, Category 5 tester. Test for faulty connectors, splices, and terminations. Test according to TIA/EIA 568-B.1, "Commercial Building Telecommunications Cabling Standards - Part 1: General Requirements." Link performance for UTP cables must comply with minimum criteria in TIA/EIA 568-B.1.

2. Test each circuit and component of each system. Tests shall include, but are not limited to, measurements of power-supply output under maximum load, signal loop resistance, and leakage to ground where applicable. System components with battery backup shall be operated on battery power for a period of not less than 10 percent of the calculated battery operating time. Provide special equipment and software if testing requires special or dedicated equipment.
3. Operational Test: After installation of cables and connectors, demonstrate product capability and compliance with requirements. Test each signal path for end-to-end performance from each end of all pairs installed. Remove temporary connections when tests have been satisfactorily completed.

C. Devices and circuits will be considered defective if they do not pass tests and inspections.

D. Prepare test and inspection reports.

3.9 STARTUP SERVICE

A. Engage a factory-authorized service representative to supervise and assist with startup service.
1. Complete installation and startup checks according to approved procedures per manufacturer's written instructions.
2. Enroll and prepare badges and access cards for Owner's operators, management, and security personnel.

3.10 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain security access system.

END OF SECTION 28 13 00

SECTION 28 13 53

IP NETWORK COMPATIBLE INTERCOM (IX SYSTEM)

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. IP Video Intercom.

1.2 REFERENCES

A. American National Standards Institute (ANSI/TIA/EIA) 568 - Commercial Building Telecommunications Cabling Standard.

B. International Organization for Standards (ISO) 9001:2000 - Quality Management Systems - Requirements.

1.3 SYSTEM DESCRIPTION

A. IP Network Compatible Video Intercom System: A network-based communication and security system featuring video entry security, internal communication, emergency stations, and paging. All units and app in the systems shall be able to unlock doors remotely on a network, assist onsite visitors from an offsite location, broadcast emergency announcements, and communicate using a PoE network.
   1. Power Source: Power over Ethernet (802.3af).
   2. Network Interface: 10 BASE-T / 100 BASE-TX Ethernet (RJ-45).
   3. Network Protocols: IPv4, IPv6, TCP, UDP, SIP, HTTP, HTTPS, MJPEG, RTSP, RTP, RTCP, IGMP, MLD, SMTP, DHCP, NTP, DNS.
   4. Bandwidth Usage:
      a. G.711: 64Kbps x 2 per video call.
      b. 64Kbps per monitor.
      c. H.264: 24Kbps ~ 2,048Kbps.
   5. Communication: Hands-free (VOX), push-to-talk (simplex), or handset (full-duplex).
   6. Video Display: 7 inch color LCD.
   7. Camera: Type:
      a. 1/3 inch color CMOS. 1.23 Megapixels.
      b. View Area at 0 degree camera angle mounted at 4 feet 11 inches AFF: 2 feet 3 inches vertical x 3 feet 9 inch horizontal at 19 inches .
   8. Video Stream: ONVIF Profile S.
   9. Door Release: Programmable Form C dry contact, 24V AC/ DC, 500mA (use RY-24L for larger contact rating, which requires 24V DC power supply) or use IXW MA with 4 4 contact inputs and 10 relay outputs.
   10. Wire Type: CAT-6.

11. Distance:
    a. Any station to Network Node: 330 feet.

1.4 SUBMITTALS

A. Product Data: Manufacturer's data sheets on each product to be used, including:
   1. Preparation instructions and recommendations.
   2. Storage and handling requirements and recommendations.
   3. Installation methods.

B. Shop Drawings: Submit the following:
   1. Wiring Diagrams: Indicate wiring for each item of equipment and interconnections between items of equipment.
   2. Include manufacturer's names, model numbers, ratings, power requirements, equipment layout, device arrangement, complete wiring point-to-point diagrams, and conduit layouts.

C. Installation and Operation Manuals:
   1. Submit manufacturer's installation and operation manual, including operation instructions and component wiring diagrams.
   2. Provide detailed information required for Owner to properly operate equipment.

D. Warranty: Submit manufacturer's standard warranty.

1.5 QUALITY ASSURANCE

A. Manufacturer Qualifications: ISO 9001:2015 certified company.

B. Installer Qualifications: Factory trained and experienced with system installations of scope and size required for the Project.

C. Mock-Up: Provide a mock-up for evaluation of surface preparation techniques and application workmanship.
   1. Finish areas designated by Architect.
   2. Do not proceed with remaining work until workmanship is approved by Architect.
   3. Refinish mock-up area as required to produce acceptable work.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Delivery: Deliver materials to site in manufacturer's original, unopened containers and packaging, with labels clearly identifying product name and manufacturer.

B. Storage: Store materials in clean, dry area indoors in accordance with manufacturer's instructions.

C. Handling: Protect materials during handling and installation to prevent damage.

1.7 PROJECT CONDITIONS

A. Maintain environmental conditions (temperature, humidity, and ventilation) within limits recommended by manufacturer for optimum results. Do not install products under environmental conditions outside manufacturer's absolute limits.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Acceptable Manufacturer: Aiphone Corp.,

B. Requests for substitutions will be considered in accordance with provisions of Section 01 60 00 - Product Requirements.

C. Basis of design: IX Series 2 Intercom System as manufactured by Aiphone Corporation.

2.2 SYSTEM DESIGN

A. Master Station(s): IX-MV7-H

B. Audio Video Door Stations:___.
   1. Model IX-DVF (Video Door Station - Flush Mount - Hands Free) Station locations as per plans.
   2. Model IX-DVF-P (Video Door Station - Flush Mount - Hands Free) Station location as per plans.

C. Provide Selective Door/Gate Release.

D. Provide Audio/video streaming via ONVIF Profile S.

E. Provide ONVIF Profile S camera input (max 500).

F. Provide Overhead paging.

G. Provide Contact input at door station.

2.3 FUNCTIONAL COMPONENTS:

A. Functional Components: As indicated on the drawings or as required to complete system.
   1. Video Master Station Series:

a. Model IX-MV7-H Color selection by Owner.
b. Model IX-MV7- Color selection by Owner.
c. An IP addressable video master station with a 7 inch color LCD monitor. It can be wall or desk mounted (desk stand included). The IX-MV7 offers handset (duplex) and hands-free (VOX/PTT) communication and call up to 500 other IX stations. It connects directly to a network using CAT-6 cable. This station requires a 802.3af compliant Power-over-Ethernet network.

2. IXW-MA IP Programmable Relay Adaptor: Multi-purpose adaptor - PoE - screen only:
   a. 4 contact inputs and 10 relay outputs (compatible with IX Series).
3. Network Paging Adapter Model IX-PA:
   a. Address book that supports up to 50 stations and can be connected to 3rd party devices. Can be accessed by an IX-MV7 master station or an instance of the IX Mobile App to allow messages to be broadcast through the IX-PA 600u or 8u output. A 3rd party device can be connected to the audio input to send messages to the paging adaptor address book.

4. Stainless Steel Security Lock Box Model LB-SDVF.
5. Electric Door Strike Model EL-12S:
   a. The door strike is designed for wood framed wooden doors. The unit operates on 12~16 V AC.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas to receive integrated security and communication system.

B. Notify Architect of conditions that would adversely affect installation or subsequent use.

C. Do not begin installation until unacceptable conditions are corrected.

3.2 PREPARATION

A. Verify the following compliance before starting installation.
   1. The unit turns inoperative during power failure.
   2. Keep the intercom wires at least 1 foot (30 cm) away from strong electrical wiring (AC 100-240 V) including, in particular, wiring for inverter electrical appliances. Noise and malfunction could result.
   3. If a strong light shines on the main unit screen, the picture may turn white or only silhouettes will be visible.
   4. Other manufacturer's devices (such as sensor, detectors, door releases) used with this system, comply with the manufacturer's installation requirements.
   5. The LCD panel is manufactured with very high precision techniques, inevitably will have a very small portion of its picture elements always lit or not lit at all. This is not considered a unit malfunction. Please be aware of this in advance.

3.3 INSTALLATION

A. Install integrated security and communication system in accordance with manufacturer's instructions at locations indicated on the Drawings.

B. Mount equipment plumb, level, square, and secure. For video entrance stations and video door stations, comply with manufacturer's design requirements to provide optimum picture quality of station monitoring.

3.4 SET-UP AND ADJUSTING

A. Adjust integrated security and communication system for proper operation in accordance with manufacturer's instructions.

3.5 DEMONSTRATION AND TRAINING

A. Demonstration:
   1. Demonstrate that integrated security and communication system functions properly.
   2. Perform demonstration at final system inspection by qualified representative of manufacturer.

B. Instruction and Training:
   1. Provide instruction and training of Owner's personnel as required for operation of integrated security and communication system.
   2. Provide hands-on demonstration of operation of system components and complete system, including user-level program changes and functions.
   3. Provide instruction and training by qualified representative of manufacturer.

3.6 PROTECTION

A. Protect installed integrated security and communication system from damage during construction.

END OF SECTION 28 13 53

SECTION 28 20 00

VIDEO SURVEILLANCE

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes a video surveillance system consisting of cameras, digital video recorder, data transmission wiring, and a control station with its associated equipment.

1.2 DEFINITIONS

A. FTP: File transfer protocol.

B. IP: Internet protocol.

C. LAN: Local area network.

D. MPEG: Moving picture experts group.

E. PC: Personal computer.

F. PTZ: Pan-tilt-zoom.

G. TCP: Transmission control protocol - connects hosts on the Internet.

H. WAN: Wide area network.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product indicated. Include dimensions and data on features, performance, electrical characteristics, ratings, and finishes.

B. Shop Drawings: For video surveillance. Include plans, elevations, sections, details, and attachments to other work.

1. Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
2. Functional Block Diagram: Show single-line interconnections between components for signal transmission and control. Show cable types and sizes.
3. Dimensioned plan and elevations of equipment racks, control panels, and consoles. Show access and workspace requirements.
4. Wiring Diagrams: For power, signal, and control wiring.

C. Design Data: Include an equipment list consisting of every piece of equipment by model number, manufacturer, serial number, location, and date of original installation. Add pretesting record of each piece of equipment, listing name of person testing, date of test, set points of adjustments, name and description of the view of preset positions, description of alarms, and description of unit output responses to an alarm.

1.4 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For cameras, power supplies, infrared illuminators, monitors, videotape recorders, digital video recorders, video switches, and control-station components to include in emergency, operation, and maintenance manuals.

1. Lists of spare parts and replacement components recommended to be stored at the site for ready access.

1.5 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of cameras, equipment related to camera operation, and control-station equipment that fail in materials or workmanship within specified warranty period.

1. Warranty Period: Three years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

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

B. Comply with NECA 1.

C. Comply with NFPA 70.

D. Electronic data exchange between video surveillance system with an access-control system shall comply with SIA TVAC.

2.2 IP CAMERAS

A. Fixed Camera
1. A 6 MP IP video camera, with multi-streaming (H.264, H.265 and MJPEG) capability in IP66/IK10 rated dome housing.
2. Video Compression and Transmission – The camera shall have the following properties relating to the video signals it produces.

a. H.265, H.264 and MJPEG compression, each derived from a dedicated encoder and capable of being streamed independently and simultaneously
    1) H.265 and H.264 – frame rates up to 30 fps (60Hz) / 25fps (50Hz) at all resolution.
    2) MJPEG – frame rates up to 15 fps(60Hz) / 12fps (50Hz) at all resolution.

3. The 6 MP camera shall be able to configure up to 10 independent video stream profiles with differing encoding, quality, frame rate, resolution, and bit rate settings.
4. Resolution selections
    a. *16:9 aspect ratio*: 3328x1872, 3072x1728, 2688x1520, 1920x1080, 1280x720, 800x448, 640x360
    b. *4:3 aspect ratio*: 2592x1944, 1600x1200, 1024x768, 800x600, 640x480, 320x240
    c. *5:4 aspect ratio*: 1280x1024, 720x576
    d. 3:2 aspect ratio: 720x480
5. The camera shall support unicast video streaming up to 20 users.
6. The camera shall support multicast video streaming up to 10 profiles.
7. Dynamic DNS (DDNS) support
8. Camera – The 6 MP camera device shall have the following physical and performance properties:
    a. Dustproof, waterproof, and IP66 rated.
    b. True day/night operation with removable IR cut filter
    c. Low light level operation to 0.05 lux at F1.2 in color mode and 0 lux in black and white mode with IR LED on.
    d. The camera shall be able to produce clear images in highly contrast scenes with multi-exposure wide dynamic range.
    e. 2D and 3D digital noise reduction
    f. Integral IR illumination, providing effective of 40m (131.23 ft) at 0 lux when activated in black and white mode.
    g. Configurable a privacy masking regions utilizing 4 point polygon.
    h. The camera shall provide video display on smart phone (iPhone, Android) to adjust viewing angle, rotation and focus.
9. Intelligence and Analytics – The 6 MP camera shall have a suite of integral intelligent operations and analytic functions to include:
    a. Motion detection with eight definable detection areas, with eight polygonal zones, and minimum/maximum object size.
    b. Detection of logical events of specified conditions from the camera's video input
        1) Defocus detection
        2) Fog detention
        3) Direction detention
        4) Motion detection
        5) Digital auto tracking
        6) Appear/Disappear
        7) Audio Detection
        8) Enter/Exit
        9) Loitering
        10) Tampering
        11) Virtual line
        12) Audio detection

13) Sound classification
14) Shock detection
15) Face/upper body detection

c. Business Intelligence features
1) People counting
2) Queue management
3) Heatmap

d. Detection and classification of the following sound:
1) Scream
2) Gunshot
3) Explosion
4) Crashing glass

10. Interoperability – The 6 MP camera shall be ONVIF Profile S / G compliant.
11. The 6 MP camera shall possess the following further characteristics:
a. Built-in web server, accessed via non-plugin browsers including Google Chrome, IE11, MS Edge, Mozilla Firefox and Apple Safari.
b. Micro SD/SDHC/SDXC memory card with configurable pre-alarm and post-alarm recording intervals
c. The camera shall provide streaming to multiple smart phones with DDNS provided freely from the manufacturer. In addition, the application shall be available for both iOS and Adroid, free of charge with search keyword, 'Wisenet Mobile'.
d. NAS recording option with configurable pre-alarm and post-alarm recording intervals.
1) Alarms and notifications
a. alarm notification triggers:
i. Analytics
ii. Network disconnect
iii. Alarm input
2) Available notification means upon trigger:
i. File Upload via FTP and E-mail
ii. Notification via E-mail
iii. Local storage (SD / SDHC / SDXC) or NAS recording at event trigers
iv. Alarm output
v. Handover
vi. Audio playback
e. Pixel Counter available in the web viewer.
f. PoE capable.

12. Basis of Design: Hanwha XNV-8082R

2.3 Multi-view Camera

A. The camera shall provide 360-degree field of view and produce video in quad view mode. It shall also provide digital PTZ along with automated video analytics to allow users to efficiently monitor large visual fields with capability to focus on certain areas when suspicious activity is observed.

B. Video Compression and Transmission – The multi-directional camera shall have the following properties relating to the video signals it produces.
   1. H.265, H.264 and MJPEG compression, each derived from a dedicated encoder and capable of being streamed independently and simultaneously
      a. H.265 and H.264 – Maximum of 30 fps at all resolutions
      b. MJPEG – Maximum of 30 fps
   2. The multi-directional camera shall be able to configure up to 10 independent video stream profiles with differing encoding, quality, frame rate, resolution, bit rate, and other video settings.
   3. The multi-directional camera shall have four lenses and each lens shall provide the following resolutions.
      a. 1920 x 1080, 1280 x 1024, 1280 x 960, 1280 x 720, 1024 x 768, 800 x 600, 800 x 448, 720 x 576, 640 x 480, 640 x 360, 320 x 240
   4. The camera shall support unicast video streaming up to 10 users.
   5. The camera shall support multicast video streaming up to 10 profiles.
   6. The camera shall be able to configure Dynamic DNS (DDNS). DDNS shall be provided with no additional cost bu the manufacturer.
   7. The multi-directional camera shall provide smart codec (WiseStream, Dynamic GOV, and Dynamic fps) to efficiently manage bit rate of the video stream and reduce storage while producing video quality that is visually equal to the one without smart codec.
   8. Viewing composition: Quad view

C. Camera – The multi-directional camera device shall have the following physical and performance properties:
   1. IK10 rated for protection against impacts
   2. IP66 for protection against dust and water
   3. True day/night operation with removable IR cut filter
      a. Low light level operation to 0.008 lux at F2.2 in color mode andand 0.008 lux in black and white mode.
   4. The camera shall be able to produce clear images in highly contrast scenes with multi-exposure wide dynamic range up to 120dB.
   5. The camera shall support digital noise reduction using both 2D and 3D noise reduction technology.
   6. The camera shall be able to configure 32 privacy masking area with polygonal.
   7. The multi-directional camera shall be able to capture high contrast scenes with 120 dB multi-exposure wide dynamic range.
   8. The camera shall provide video display on smart phone (iPhonem Android) to adjust viewing angle, rotation and focus.
   9. One touch (Simple) or manual focus controllable remotely via network. The camera shall have motorized varifocal lens.
   10. Advanced digital image stabilization with built in gyro sensor. The camera shall be able to measure movements in three axes and accurately enhance images from distortions caused by instability.
   11. The camera shall support Pan/Tilt/Rotate through Remote adjustment by 200 cycles.

D. Intelligence and Analytics – The multi-directional camera shall have a suite of intelligent analytic functions.
   1. Motion detection with 8 definable detection areas with 8 polygonal zones, and minimum/maximum object size.

2. Detection of logical events of specified conditions from the camera's video input
    a. camera tamper (scene change)
    b. loitering
    c. directional detection
    d. defocus detection
    e. fog detection
    f. virtual line
    g. enter/exit
    h. appear/disappear

E. Interoperability – The multi-directional camera shall be ONVIF Profile S and T compliant.

F. The multi-directional camera shall possess the following further characteristics:
1. Built-in web server, accessed via standard browsers including Google Chrome. IE11, MS Edge, Mozilla Firefox and Apple Safari.
2. Micro SD/SDHC/SDXC memory card options, with configurable pre-alarm and post-alarm recording intervals
3. Alarms and notifications
    a. alarm notification triggers:
        1) alarm input
        2) motion detection
        3) video analytics
        4) network disconnect
    b. available notification means upon trigger:
        1) file upload via FTP and e-mail
        2) notification via e-mail
        3) record to local storage (SD/SDHC/SDXC card)
        4) external output
        5) Pixel Counter available in the plug-in web viewer

4. HPoE capable
5. Basis of Design: Hanwa PNM-9084QZ

2.4 CAMERA-SUPPORTING EQUIPMENT

A. Minimum Load Rating: Rated for load in excess of the total weight supported times a minimum safety factor of two.

B. Pan-and-Tilt Units: Motorized units arranged to provide remote-controlled aiming of cameras with smooth and silent operation and equipped with matching mounting brackets.

1. Panning Rotation: 0 to 355 degrees, with adjustable stops.
2. Tilt Movement: 90 degrees, plus or minus 5 degrees, with adjustable stops.
3. Speed: 12 degrees per second in both horizontal and vertical planes.
4. Wiring: Factory prewired for camera and zoom lens functions and pan-and-tilt power and control.
5. Built-in encoders or potentiometers for position feedback, and thermostat-controlled heater.

6. Pan-and-tilt unit shall be available with preset positioning capability to recall the position of a specific scene.

C. Mounting Brackets for Fixed Cameras: Type matched to items supported and mounting conditions. Include manual pan-and-tilt adjustment.

D. Outdoor Protective Housings for Cameras: Aluminum enclosures with internal camera mounting and connecting provisions that are matched to camera/lens combination and mounting and installing arrangement of camera to be housed.

1. Mechanical (Vandal) Protection: IK10
2. Ingress Protection: IP66
3. Alignment Provisions: Camera mounting shall provide for field aiming of camera and permit removal and reinstallation of camera lens without disturbing camera alignment.
4. Built-in, thermostat-activated heater and blower units. Units shall be automatically controlled so the environmental limits of the camera equipment are not exceeded.
5. Sun shield shall not interfere with normal airflow around the housing.
6. Mounting bracket and hardware for wall or ceiling mounting of the housing. Bracket shall be of same material as the housing; mounting hardware shall be stainless steel.
7. Finish: Housing and mounting bracket shall be factory finished using manufacturer's standard finishing process suitable for the environment.

2.5 NETWORK VIDEO RECORDERS

A. Features:

1. Data Storage: Up to 42TB raw storage
2. Solid state hard disk drive for Windows operating system
3. 470 Mbps of recording throughput
4. SSD & 24/7 Duty Cycle SATA Drives
5. Network interface: 2 x RJ Gigabit Ethernet
6. 1 x Intel Xeon Processor
7. 16GB, 2 x 8GB DDR4 memory

B. Basis of Design: Wisenet WISE WRR-P-E200x1

2.6 VIDEO MANAGEMENT SOFTWARE (VMS)

A. Description:
1. The specified product shall be an open video platform designed for use in any video application.
2. The specified software shall include, free of charge, any API or SDKs necessary to integrate 3rd party devices and systems

B. The specified software shall include, free of charge, any API or SDKs necessary to integrate 3rd party devices and systems. VMS Sofware Components:

1. The System shall be comprised of four (4) applications which work together seamlessly.
    a. Cloud – a cloud application that enables simple remote connectivity, viewing, and management of an unlimited number of systems and users.
    b. Server – a media server responsible for discovering, connecting to, and managing system users, devices, and associated data.
    c. Desktop- a desktop application capable of acting as a stand-alone media player or as a client application for connecting to and managing systems.
    d. Mobile – a mobile application for iOS and Android devices that allows users to connect to, view, search, and control IP cameras over WIFI or Data networks.

C. VMS System Architecture

1. The VMS shall have a Server Hive Architecture wherein:
    a. All servers in a system are equal and synchronize system databases in real-time
    b. A user can connect to any system server to see and manage the entire system.
    c. Servers support automatic camera failover to ensure limited loss of video recording in the event of hardware or network failure.
    d. Servers will use a SQLite - a free database technology - included in the installation package.
2. The VMS shall support one-click system wide updates.
    a. System Administrators shall be able to upgrade an entire system via a single button in the Desktop Application.
    b. System Administrators shall be able to upgrade on demand to the latest release or specific builds with specific functionality or bug fixes.
    c. System Administrators shall be able to apply an OTA (over-the-air) update.
    d. Systems Administrators shall be able to generate a URL to download a portable system- specific update package in .zip file format which can be used to update servers without an active Internet connection.
3. The VMS will use secure technologies for inter-application communication and security.
    a. OpenSSL for network connections - deprecated and insecure protocols and use only TLS v1+.
    b. Server to Client (Mobile, Desktop, Web) Communications- Option to force encryption between Client and Server for API data.
    c. Option to force HTTPS video traffic encryption between Client and Server.
    d. HTTPS Email notification - TLS / SSL - TLS is the default option for Email Server communications.
    e. Salted/Hashed Passwords - Local Credentials will be protected using a salted MD5 hash, Cloud Credentials should use a complex multi-level hash.
4. The VMS will not require any licenses to increase the number of supported devices, users, or servers.
5. The system shall support scaling to support the maximum recommended system sizes shown below. The system shall support exceeding these recommended maximums by consulting with engineering support.

a. The system shall support a maximum of 100 Servers in a system.
b. The system shall support a maximum of 10,000 resources in a system.
c. The system shall support a maximum of 1,000 concurrent users in a system.

D. VMS Server Application

1. The VMS Server application shall be able to rub on any of the following operating systems: Microsoft Windows, Ubuntu Linux, NVIDIA Jetson Support.
2. The VMS Server application will be capable of operating on any hardware able to run a compatible operating system.
3. The VMS Server will be capable of recording 128 dual-streaming IP cameras (256 streams) on a single core of an Intel Core i3 processor.
4. Features
   a. The VMS Server Application shall automatically discover, stream, and record any ONVIF Profile S IP camera located on the same subnet as the server application.
   b. The VMS Server Application shall manually discover, stream, and record RTSP, HTTP, or UDP (multicast, unicast) streams.
   c. The VMS Server application shall support up to 1000 concurrent TCP connections
   d. The VMS Server application shall record and stream video of any resolution and frame rate, limited only by hardware.
   e. The VMS Server application shall support automatic camera failover without any additional licenses.
   f. The VMS Server application will support an unlimited number of users and custom user roles.
   g. The VMS Server application shall support any type of storage medium - HDD's, SSD's, SD cards, DAS, NAS, or other network-attached storage devices or locations.
   h. The VMS Server application shall support LDAP / Active Directory / Open LDAP integration for user login credential management
   i. The VMS Server application shall record and stream H.264, H.265, and MJPEG streams.
   j. The VMS Server application shall record and stream AAC, PCM (Mu-Law, A-law), g726, and MP3 audio.
   k. The VMS Server application shall transcode streams on demand for delivery to 3rd party systems or devices in H.265, H.264, MJPEG or WebM codecs.
   l. The VMS Server application shall be able to provide pass-through high or low-res HLS streams from connected devices.
   m. The VMS Server application shall store archive indices in the same location as recorded video files.
   n. The VMS Server application shall allow system administrators to recover archives from any storage medium using a re-index archive feature.
   o. The VMS Server application will contain a boolean events engine allowing operators to program and trigger system actions based on system, connected device, or HTTP events sent from 3rd party system or device.
   p. The VMS Server application shall be able to send HTTP PUT or GET requests to 3rd party systems or devices.
   q. The VMS Server application shall support IPv4 or IPv6 addressing.

r. The VMS Server application shall allow operators to set custom network routing configurations for system servers to optimize network routing and usage.
s. The VMS Server application shall allow operators to monitor the CPU, RAM, NIC, and HDD usage in real time.
t. The VMS Server application shall track all operator actions to allow audits
u. The VMS Server application shall generate automatic crash files every time there is an unexpected crash of the Server application.
v. The VMS Server application shall allow operators to change the size of reserved disk space for storage drives.
w. The VMS Server application shall automatically disable any system drive (drive containing the operating system) in computing hardware with more than one drive to ensure the operating system drive does not become full.
x. The VMS Server application shall support configuration and events from binary I/O contacts on supported devices - including IP cameras and I/O devices.
y. The VMS Server application shall support sending email notifications via SMTP using TLS, SSL or unsecured connections.
z. The VMS Server application shall support scheduled backup of recording archives to local, networked, or cloud storage locations.
aa. The VMS Server application shall allow on-demand backup of recording archives to local, networked, or cloud storage locations.
bb. The VMS Server application shall allow concurrent-recording of all connected cameras / streams to two (2) servers in real-time.
cc. The VMS Server application will allow server-side, CPU-based motion analysis for all connected IP cameras with no perceptible increase (<3%) in CPU usage.
dd. The VMS Server application will require no dedicated GPU in order to perform at maximum capacity.
ee. The VMS Server application will have a web administration interface that allows users to view live or recorded video from a single camera at a time in high or low resolutions.
ff. The VMS Server application will have a web administration interface that allows system administrators to view real-time server health monitoring statistics (CPU, NIC, and HDD usage).
gg. The VMS Server application will have a web administration interface that allows operators to cloud merge two systems together or disconnect the VMS Server from the VMS cloud application.
hh. The VMS Server application will have a web administration interface that allows users to view all available servers in the system.
ii. The VMS Server application will have a web administration interface that allows operators to switch between server interfaces.
jj. The VMS Server application will have a hidden advanced page that gives system administrators the ability to modify advanced system settings.
kk. The VMS Server application will support any RAID configuration of storage medium

E. VMS Desktop Application

1. Supported Operating Systems: Microsoft Windows, Ubuntu Linux, Apple/Mac.

2. The VMS Desktop application will be capable of operating on any hardware able to run a compatible operating system with a CPU that supports OpenGL 2.1 and Intel HD Graphics 3000 (or higher).
3. The VMS Desktop application shall not require any dedicated graphics drive to work at full capacity (64 streams on a 64 bit OS) and shall use the CPU for all video decoding and rendering.
4. Features:
    a. The VMS Desktop Application will have the following basic structure:
        1) Navigation Panel - with a main menu button, an interactive cloud-login icon, tabbed layouts, minimize and maximize icons, a contextual help icon, and a close application icon.
        2) Resource Panel (Left) - contains all system resources (Servers, Devic es, Users, Layouts, Offline files, etc.) with collapsible structure and a keyword search mechanism to allow operators to quickly search for a display live streams / cameras, offline video and image files, or any combination thereof.
        3) Notifications Panel (Right) - shows all system or rules-engine generated notifications which can be clicked on to display relevant resource in the Viewing Grid
        4) Timeline Panel (Bottom) - allows for navigation and search of recorded video files
        5) Viewing Grid (Main Viewing Area) - a flexible adaptive grid interface which allows operators to create and share customized layouts of system resources.
    b. The VMS Desktop application shall allow operators to view and interact with the following types of media:
        1) Live Streams: H.265, H.264, MJPEG
        2) Offline Media: AVI MKV MP4 MOV TS M2TS MPEG MPG FLV WMV 3GP JPG PNG GIF BMP TIFF
        3) I/O Devices: Status and Triggers
        4) Servers: Real-Time Server Health Monitoring Status
    c. The VMS Desktop application shall allow the operator to scroll to zoom in to any part of the Viewing Grid.
    d. The VMS Desktop application shall allow operator to drag & drop to reassign cameras from one server to another server.
    e. The VMS Desktop application will have a flexible timeline that allows operators to view the dates of any and all archived video in the System for a specific camera, or groups of cameras.
    f. The VMS Desktop application will allow operators to manually create bookmarks - with a start time, end time, name, description, and tags - for later search. Bookmarks shall also be able to be created using the Rules engine.
    g. The VMS Desktop application shall allow operators to create Soft Triggers - programmable, customizable buttons which sit on top of streams in the Viewing Grid - to trigger any available system action.
    h. The VMS Desktop application shall have icons located on the top of live camera streams which allow operators to dewarp fisheye cameras, control PTZ cameras, apply client-side image enhancement, execute smart motion search, create zoom windows, rotate items to any orientation, and activate stream or file info.

i. The VMS Desktop application shall allow operators to create Zoom Windows (up to 63 zoom windows on a single item in a 64 bit OS) - a magnified view of a part of a live stream, recorded videos, or static images.
j. The VMS Desktop application shall allow operators the ability to execute a Smart Motion search by selecting a subset of a live camera stream with results shown in red on the flexible timeline. Smart Motion search should be able to search a year (12 months, 365 days) of archived video in less than one (1) second.
k. The VMS Desktop application will allow users to search live cameras by name, manufacturer, IP address, MAC address, and status (e.g. live).
l. The VMS Desktop application shall allow operators to search video archives by date and time with a responsive, adaptive timeline.
m. The VMS Desktop application will allow operators to customize the background image of the application with supported image types.
n. The VMS Desktop application will support digital mapping by allowing operators to add and customize background images - including opacity and number of grid points.
o. The VMS Desktop application will utilize adaptive scaling technology to automatically switch between high and low resolution streams during live and recording playback to optimize CPU and network usage.
p. The VMS Desktop application will allow operators to log in to the Cloud application in order to quickly connect to any shared system.
q. The VMS Desktop application will allow operators to quickly switch between previously connected or cloud-accessible systems using searchable tiles that show system name and status.
r. The VMS Desktop application will have a Storage Analytics feature allowing operators to analyze storage capacity of the system based on available drives and real-time and historical bandwidth analysis.
s. The VMS Desktop application will allow management and configuration of all System devices, users, and resources in a single unified interface.
t. The VMS Desktop application will allow fast-forward and fast-reverse of archived video up to 16x normal speed.
u. The VMS Desktop application will show operators which system server they are connected to.
v. The VMS Desktop application will allow operators to connect to previous versions by automatically downloading and switching to compatible versions.
w. The VMS Desktop applications will automatically discover available systems on the same network as the computer running the Desktop application.
x. The VMS Desktop application will automatically recover and reconnect to a system in the instance the server the operator is connected to becomes inaccessible for any reason.
y. The VMS Desktop application will allow operators to show or hide adaptive thumbnails in the timeline panel.
z. The VMS Desktop application will allow operators to synchronize all items on a layout or disable synchronization to view live and recorded video at the same time.
aa. The VMS Desktop application will have adaptive settings dialogs, allowing operators to switch dialog content while the dialog is open by clicking on a resource.

bb. The VMS Desktop application will allow batch configuration of camera recording schedules, fps, and quality.
cc. The VMS Desktop application will allow operators to drag and drop multiple system resources onto the Viewing Grid at the same time.
dd. The VMS Desktop Application will allow administrators to modify time synchronization settings for the system to utilize online resources (NTP servers) or to set a dedicated local time server.
ee. The VMS Desktop Application will allow system administrators to view a full list of system cameras and devices in a single dialog.
ff. The VMS Desktop application will allow operators to view, search and export all system events.
gg. The VMS Desktop application will allow operators to view, search and export all system bookmarks.
hh. The VMS Desktop application will allow operators to view, search, and export system logs.
ii. The VMS Desktop application will allow operators to view, search, and export an audit trail of all operator actions and replay related video.
jj. The VMS Desktop application will allow administrators to backup and restore the system database.
kk. The VMS Desktop application will allow administrators to create an unlimited number of custom user roles.
ll. The VMS Desktop application will allow administrators to create and share lockable layouts.
mm. The VMS Desktop application will allow administrators to update layouts in real time.
nn. The VMS Desktop application will allow users to record their screen in full resolution and up to 30fps.
oo. The VMS Desktop application will allow users to add a local folder to add local files for search and playback.
pp. The VMS Desktop application will have a Video Wall mode which will allow operators to control the application remotely.
qq. The VMS Desktop application will have a Media Player mode which will allow operators to use the application as a media player.
rr. The VMS Desktop application will remember past system connections and user credentials and will allow operators to quickly search for and switch between systems.
ss. The VMS Desktop application will allow operators to adjust the aspect ratio and streaming quality (high resolution or low resolution) of items displayed on the viewing grid.
tt. The VMS Desktop application will display I/O devices as an individual item on the viewing grid and allow operators to create custom names for inputs and output.
uu. The VMS Desktop application will allow users to customize the layout of I/O panels on the item in the viewing grid including indicators for inputs and buttons for outputs.
vv. The VMS Desktop application will allow users to de-warp any fisheye lens using automatic calibration or manual calibration without the need for any third (3rd) party SDKs.
ww. The VMS Desktop application will allow users to create fully customizable viewing tours which include any combination of live video streams, offline

videos, images, websites (or URLs), I/O devices, and Server health monitoring status.

xx. The VMS Desktop application will allow system administrators to modify and save a shared layout to affect an instantaneous change to that layout on the VMS Desktop application of any user connected to the system viewing that layout (when the system administrator saves the layout the layout will update in real time for any user viewing that layout).

yy. The VMS Desktop application will support two-way audio between operators and supported devices.

zz. The VMS Desktop application will support audio alerts as an action that can be played on users' computers or connected system devices.

aaa. The VMS Desktop application will support PTZ presets and tours.

bbb. The VMS Desktop application will support PTZ presets and tours in fisheye cameras using de-warp mode.

ccc. The VMS Desktop application will allow operators to schedule recording for connected cameras and devices with options to force minimum and maximum storage durations.

ddd. The VMS Desktop application will allow operators to configure pre and post recording for motion events.

eee. The VMS Desktop application will allow operators to optimize camera streaming quality from connected devices automatically using low, medium, high, best quality selectors or manually in the camera.

fff. The VMS Desktop application will allow users to export video by selecting an area on the timeline and right clicking to export.

ggg. The VMS Desktop application will support single video export in .avi, .mp4, or .mkv formats and will offer the option to transcode any client-side effects (image enhancement, de-warping, timestamps) as part of the exported video.

hhh. The VMS Desktop application will support multi-video export in an executable format to create a fully portable version of the VMS Desktop application including all exported video files.

iii. The VMS Desktop application shall have a rapid review export feature which will allow operators to compress any length of video into a short video (e.g. export 8 hours of archives into a 30 second video clip).

jjj. The VMS Desktop application shall allow system administrators to activate or deactivate system licenses on Internet connected systems.

kkk. The VMS Desktop application shall allow users to force open an alarm layout triggered by any system or 3rd party event with one or many associated cameras or resources.

lll. The VMS Desktop application will have a hidden configurable method of increasing the amount of items allowed on the viewing grid.

mmm. The VMS Desktop application shall allow users to adjust configuration of devices.

nnn. The VMS Desktop application shall support keyboard shortcuts to control various interface options including PTZ mode, Smart Search mode, & layout control.

ooo. VMS will allow analytics from Wisenet and other supported device with analytics (Axis, DW, Hikvision)

ppp. The VMS Desktop application will force users to set an initial password for Wisenet camera upon enrollment, for best cyber security practices.

F. VMS Mobile Application

1. Supported Operating Systems: Google Android, Apple iOS.
2. Features:
    a. The VMS Mobile application will automatically discover available Systems on a local area network (LAN).
    b. The VMS Mobile application will store past system connections and credentials and will allow users to quickly search for switch between systems.
    c. The VMS Mobile application will have adaptive streaming and automatically adjust the stream being displayed based on network speed.
    d. The VMS Mobile application will allow users to adjust streaming resolutions manually.
    e. The VMS Mobile application will allow users to search for cameras by name.
    f. The VMS Mobile application will allow fisheye de-warping of any fisheye lens without the need for any 3rd party SDK.
    g. The VMS Mobile application will allow users to view live video from one system.
    h. The VMS Mobile application will allow users to log in to the VMS Cloud layer in order to view and access all systems shared with a user.
    i. The VMS Mobile application will allow users to control the display of any connected "Lite Clients" in the system.
    j. The VMS Mobile application will utilize a custom media player to render and display live thumbnails and video.
    k. The VMS Mobile application will allow users to search video using a calendar.
    l. The VMS Mobile application will allow users to search video using a flex timeline.
    m. The VMS Mobile application will allow “Smart Motion Search” to search archived video by selecting an entire video or specific area.

G. VMS Cloud Application

1. Supported Browsers
    a. The VMS Cloud application will allow users to log in from any modern web browser (Google Chrome, Mozilla Firefox, Microsoft Edge, Opera, etc.) from any type of device (mobile, pc, etc.)
2. Features:
    a. The VMS Cloud application will be an optional add-on to the VMS requiring no additional licensing.
    b. The VMS Cloud application will allow users to connect an unlimited number of systems to a single user account.
    c. The VMS Cloud application will allow system administrators to share access to a system using only an email address.
    d. The VMS Cloud application will allow system administrators to assign custom user roles when sharing system access.
    e. The VMS Cloud application will allow users to quickly search for and connect to cloud-connected systems by name.
    f. The VMS Cloud application will allow operators to view live or recorded video from one camera at a time on any cloud-connected system.

g. The VMS Cloud application will first attempt a direct connection to system servers using NAT Traversal technology and will be able to proxy traffic to ensure access to a system in the case of ISP or routing issues.
h. The VMS Cloud application will allow an unlimited number of connected users and systems with no additional licensing.
i. The VMS Cloud application will utilize secure networking technologies (OpenSSL, HTTPS) and a complex Salted MD5 hash for any stored passwords.
j. The VMS Cloud application will allows two systems to be merged together to operate as one system without the need for port forwarding or local access.

H. Basis of Design: Hanwha Wisenet WAVE

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine pathway elements intended for cables. Check raceways and other elements for compliance with space allocations, installation tolerance, hazards to camera installation, and other conditions affecting installation.

B. Examine roughing-in for LAN, WAN, and IP network before device installation.

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

3.2 WIRING

A. Comply with requirements in Section 270528 "Pathways for Communications Systems."

B. Splices, Taps, and Terminations: For power and control wiring, use numbered terminal strips in junction, pull, and outlet boxes; terminal cabinets; and equipment enclosures. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A-486B.

C. For communication wiring, comply with the following:
1. Section 271513 "Communications Copper Horizontal Cabling."

3.3 VIDEO SURVEILLANCE SYSTEM INSTALLATION

A. Install cameras level and plumb.

B. Install cameras with 84-inch minimum clear space below cameras and their mountings. Change type of mounting to achieve required clearance.

C. Set pan-and-tilt unit stops to suit final camera position and to obtain the field of view required for camera. Connect all controls and alarms and adjust.

D. Identify system components, wiring, cabling, and terminals according to Section 270553 "Identification for Communications Systems."

3.4 FIELD QUALITY CONTROL

A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.

B. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust components, assemblies, and equipment installations, including connections.

C. 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.

D. Tests and Inspections:

1. Inspection: Verify that units and controls are properly installed, connected, and labeled, and that interconnecting wires and terminals are identified.
2. Pretesting: Align and adjust system and pretest components, wiring, and functions to verify that they comply with specified requirements. Conduct tests at varying lighting levels, including day and night scenes as applicable. Prepare video-surveillance equipment for acceptance and operational testing as follows:

    a. Prepare equipment list described in "Informational Submittals" Article.
    b. Verify operation of auto-iris lenses.
    c. Set back-focus of fixed focal length lenses. At focus set to infinity, simulate nighttime lighting conditions by using a dark glass filter of a density that produces a clear image. Adjust until image is in focus with and without the filter.
    d. Set back-focus of zoom lenses. At focus set to infinity, simulate nighttime lighting conditions by using a dark glass filter of a density that produces a clear image. Additionally, set zoom to full wide angle and aim camera at an object 50 to 75 feet away. Adjust until image is in focus from full wide angle to full telephoto, with the filter in place.
    e. Set and name all preset positions; consult Owner's personnel.
    f. Set sensitivity of motion detection.
    g. Connect and verify responses to alarms.
    h. Verify operation of control-station equipment.

3. Test Schedule: Schedule tests after pretesting has been successfully completed and system has been in normal functional operation for at least 14 days. Provide a minimum of 10 days' notice of test schedule.

4. Operational Tests: Perform operational system tests to verify that system complies with Specifications. Include all modes of system operation. Test equipment for proper operation in all functional modes.

E. Video surveillance system will be considered defective if it does not pass tests and inspections.

F. Prepare test and inspection reports.

3.5 ADJUSTING

A. Occupancy Adjustments: When requested within 12 months of 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. Tasks shall include, but are not limited to, the following:

1. Check cable connections.
2. Check proper operation of cameras and lenses. Verify operation of auto-iris lenses and adjust back-focus as needed.
3. Adjust all preset positions; consult Owner's personnel.
4. Recommend changes to cameras, lenses, and associated equipment to improve Owner's use of video surveillance system.
5. Provide a written report of adjustments and recommendations.

3.6 CLEANING

A. Clean installed items using methods and materials recommended in writing by manufacturer.

B. Clean video-surveillance-system components, including camera-housing windows, lenses, and monitor screens.

3.7 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain video-surveillance equipment.

END OF SECTION 28 20 00

SECTION 28 31 11

DIGITAL, ADDRESSABLE FIRE-ALARM SYSTEM

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Fire-alarm control unit.
2. Manual fire-alarm boxes.
3. System smoke detectors.
4. Heat detectors.
5. Notification appliances.
6. Device guards.
7. Magnetic door holders.
8. Remote annunciator.
9. Addressable interface device.
10. Digital alarm communicator transmitter.
11. Network communications.

1.2 DEFINITIONS

A. FACP: Fire Alarm Control Panel.

B. NICET: National Institute for Certification in Engineering Technologies.

C. PC: Personal computer.

1.3 ACTION SUBMITTALS

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

1. Include construction details, material descriptions, dimensions, profiles, and finishes.
2. Include rated capacities, operating characteristics, and electrical characteristics.

B. Shop Drawings: For fire-alarm system.

1. Comply with recommendations and requirements in the "Documentation" section of the "Fundamentals" chapter in NFPA 72.
2. Include plans, elevations, sections, details, and attachments to other work.
3. Include details of equipment assemblies. Indicate dimensions, weights, loads, required clearances, method of field assembly, components, and locations.

Indicate conductor sizes, indicate termination locations and requirements, and distinguish between factory and field wiring.

4. Detail assembly and support requirements.
5. Include voltage drop calculations for notification-appliance circuits.
6. Include battery-size calculations.
7. Include input/output matrix.
8. Include statement from manufacturer that all equipment and components have been tested as a system and meet all requirements in this Specification and in NFPA 72.
9. Include performance parameters and installation details for each detector.
10. Verify that each duct detector is listed for complete range of air velocity, temperature, and humidity possible when air-handling system is operating.
11. Provide program report showing that air-sampling detector pipe layout balances pneumatically within the airflow range of the air-sampling detector.
12. Include plans, sections, and elevations of heating, ventilating, and air-conditioning ducts, drawn to scale; coordinate location of duct smoke detectors and access to them.

    a. Show critical dimensions that relate to placement and support of sampling tubes, detector housing, and remote status and alarm indicators.
    b. Show field wiring required for HVAC unit shutdown on alarm.
    c. Locate detectors according to manufacturer's written recommendations.
    d. Show air-sampling detector pipe routing.

13. Include voice/alarm signaling-service equipment rack or console layout, grounding schematic, amplifier power calculation, and single-line connection diagram.
14. Include floor plans to indicate final outlet locations showing address of each addressable device.

C. General Submittal Requirements:

1. Shop Drawings shall be prepared by persons with the following qualifications:

    a. Trained and certified by manufacturer in fire-alarm system design.
    b. NICET-certified, fire-alarm technician; **Level III** minimum.

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer.

B. Field quality-control reports.

C. Sample Warranty: For special warranty.

1.5 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. Record copy of site-specific software.
    g. 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.

    h. Manufacturer's required maintenance related to system warranty requirements.
    i. 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.

1.6 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. Smoke Detectors, Heat Detectors**,** : No less than TEN PERCENT of amount of each type installed, but no fewer than one unit of each type.
2. Detector Bases: No less than TEN PERCENT of amount of each type installed, but no fewer than one unit of each type.
3. Manual Fire Alarm Box: ONE of each type installed.
4. Keys and Tools: ONE extra set for access to locked or tamper-proofed components.
5. Audible and Visual Notification Appliances: THREE of each type installed.
6. Addressable interface device: TWO 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.

1.7 QUALITY ASSURANCE

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

1.8 PROJECT CONDITIONS

A. Perform a full test of the existing system prior to starting work. Document any equipment or components not functioning as designed.

B. Use of Devices during Construction: Protect devices during construction unless devices are placed in service to protect the facility during construction.

1.9 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 Period: FIVE years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 SYSTEM DESCRIPTION

A. Noncoded, UL-listed addressable system, with multiplexed signal transmission and voice, /strobe evacuation.

B. Automatic sensitivity control of certain smoke detectors.

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

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.

2.2 SYSTEMS OPERATIONAL DESCRIPTION

A. Fire Alarm Signal:

1. Fire Alarm signal initiation shall be by one or more of the following devices and/or systems:
    a. Manual stations.
    b. Heat detectors.
    c. Smoke detectors.
    d. Duct smoke detectors.
    e. Carbon monoxide detectors.
    f. Combustible gas detectors.
    g. Automatic sprinkler system water flow.
    h. Fire-extinguishing system operation.
    i. Fire standpipe system.

2. Fire-alarm signal shall initiate the following actions:
    a. Continuously operate alarm notification appliances**,** including voice evacuation notices.
    b. Identify alarm and specific initiating device at fire-alarm control unit**s** and remote annunciators.
    c. Identify alarm and specific initiating device at connected network control panels and/or off-premises network control panels.
    d. Transmit an alarm signal to the remote alarm receiving station.
    e. Unlock electric door locks in designated egress paths.
    f. Release fire and smoke doors held open by magnetic door holders.
    g. Activate voice/alarm communication system.
    h. Switch heating, ventilating, and air-conditioning equipment controls to fire-alarm mode.
    i. Close smoke dampers in air ducts of designated air-conditioning duct systems.
    j. Recall elevators to primary or alternate recall floors.
    k. Activate elevator power shunt trip.
    l. Activate emergency lighting control.
    m. Activate emergency shutoffs for gas and fuel supplies.
    n. Record events in the system memory.

B. Supervisory Signal:

1. Supervisory signal initiation shall be by one or more of the following devices and actions:
    a. Valve supervisory switch.
    b. Elevator shunt-trip supervision.
    c. Independent fire-detection and -suppression systems.
    d. User disabling of zones or individual devices.
    e. Loss of communication with any panel on the network.
    f. Generator running
    g. Generator abnormal condition (e.g. failure to start, temperature alarms, low fluids, etc.)

2. System Supervisory signal shall initiate the following actions:

a. Identify specific device initiating the event at fire-alarm control unit, connected network control panels, off-premises network control panels, and remote annunciators.
b. After a time delay of 200 seconds, transmit a trouble or supervisory signal to the remote alarm receiving station.
c. Transmit system status to building management system.

C. System Trouble Signal:

1. System trouble signal initiation shall be by one or more of the following devices and actions:
   a. Open circuits, shorts, and grounds in designated circuits.
   b. Opening, tampering with, or removing alarm-initiating and supervisory signal-initiating devices.
   c. Loss of communication with any addressable sensor, input module, relay, control module, remote annunciator, printer interface, or Ethernet module.
   d. Loss of primary power at fire-alarm control unit.
   e. Ground or a single break in internal circuits of fire-alarm control unit.
   f. Abnormal ac voltage at fire-alarm control unit.
   g. Break in standby battery circuitry.
   h. Failure of battery charging.
   i. Abnormal position of any switch at fire-alarm control unit or annunciator.
   j. Voice signal amplifier failure.
   k. Hose cabinet door open.

2. System trouble signal shall initiate the following actions:
   a. Identify specific device initiating the event at fire-alarm control unit, connected network control panels, off-premises network control panels, and remote annunciators.
   b. Transmit system status to building management system.

2.3 FIRE-ALARM CONTROL UNIT

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

1. Fire-Lite Alarms.
2. GAMEWELL.
3. GE UTC Fire & Security; A United Technologies Company.
4. Notifier.
5. Siemens Industry, Inc.; Fire Safety Division.
6. Silent Knight.
7. SimplexGrinnell LP.
8. EST Edwards

B. 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. The FACP shall be listed for use with supervisory signals from other essential building systems.
    f. 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 and shall provide selective silencing of alarm notification appliance by building communication zone.
3. Addressable Control Circuits for Operation of Notification Appliances and Mechanical Equipment: The FACP shall be listed for releasing service.

C. Alphanumeric Display and System Controls: Arranged for interface between human operator at fire-alarm control unit and addressable system components including annunciation and supervision. Display alarm, supervisory, and component status messages and the programming and control menu.

1. Annunciator and Display: Liquid-crystal type, two line(s) of 40 characters, minimum.
2. Keypad: Arranged to permit entry and execution of programming, display, and control commands**.**

D. Initiating-Device, Notification-Appliance, and Signaling-Line Circuits:

1. Contractor shall verify quantity of each circuit type required with his approved equipment vendor prior to bidding. Fire alarm riser drawings that may be shown on the drawings are intended to be schematic in nature and may not depict all circuits where multiple circuits are required.
2. Pathway Class Designations: NFPA 72, Class B.
3. Pathway Survivability: Level 1.
4. Install no more than 50, addressable devices on each signaling-line circuit.
5. Serial Interfaces:

    a. One dedicated RS 485 port for remote station operation using point ID DACT.
    b. One RS 485 port for remote annunciators, Ethernet module, or multi-interface module (printer port).
    c. One USB RS 232 port for PC configuration.

d. One RS 232 port for voice evacuation interface.

E. Smoke-Alarm Verification:

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.

F. 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.

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

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

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

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

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

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

1. Batteries: Sealed, valve-regulated, recombinant lead acid, Sealed lead calcium**.**

L. Surge Suppression: Provide surge suppression devices at each 120V circuit serving fire alarm equipment. Refer to specification section 26 43 13 – Surge Protection for Low Voltage Electrical Power for requirements.

M. 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.

2.4 REMOTE FIRE ALARM DEVICES

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

1. Cooper Wheelock.
2. Fire-Lite Alarms.
3. GAMEWELL.
4. GE UTC Fire & Security; A United Technologies Company.
5. Notifier.
6. Siemens Industry, Inc.; Fire Safety Division.
7. Silent Knight.
8. SimplexGrinnell LP.
9. System Sensor.

B. Manual Fire-Alarm Boxes

1. 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.
    a. Double-action mechanism requiring two actions to initiate an alarm, breaking-glass or plastic-rod pull-lever type; with integral addressable module arranged to communicate manual-station status (normal, alarm, or trouble) to fire-alarm control unit.
    b. Station Reset: Key- or wrench-operated switch.
    c. Indoor Protective Shield: 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. Provide where indicated on plans.

C. Notification Appliances

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

a. 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.

2. 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.
   a. Rated Light Output minimum:
      1) 15 cd. in corridors and transition spaces, unless otherwise noted.
      2) 30 cd. in other spaces, unless otherwise noted.
   b. Mounting: Wall mounted unless otherwise indicated.
   c. For units with guards to prevent physical damage, light output ratings shall be determined with guards in place.
   d. Flashing shall be in a temporal pattern, synchronized with other units.
   e. Strobe Leads: Factory connected to screw terminals.
   f. Mounting Faceplate: Factory finished, WHITE.

3. Voice/Tone Notification Appliances:
   a. Comply with UL 1480.
   b. Speakers for Voice Notification: Locate speakers for voice notification to provide the intelligibility requirements of the "Notification Appliances" and "Emergency Communications Systems" chapters in NFPA 72.
   c. High-Range Units: Rated 2 to 15 W.
   d. Low-Range Units: Rated 1 to 2 W.
   e. Mounting: Flush semirecessed or surface mounted and bidirectional.
   f. Matching Transformers: Tap range matched to acoustical environment of speaker location.
   g. Mounting Faceplate: Factory finished, WHITE.

4. Exit Marking Audible Notification Appliance:
   a. Exit marking audible notification appliances shall meet the audibility requirements in NFPA 72.
   b. Provide exit marking audible notification appliances at the entrance to all building exits.
   c. Provide exit marking audible notification appliances at the entrance to areas of refuge with audible signals distinct from those used for building exit marking.

D. Addressable Interface Device

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

2. Monitor Module: Microelectronic module providing a system address for alarm-initiating devices for wired applications with normally open contacts.
3. Integral Relay: Capable of providing a direct signal to elevator controller to initiate elevator recall to circuit-breaker shunt trip for power shutdown .
   a. Allow the control panel to switch the relay contacts on command.

b. Have a minimum of two normally open and two normally closed contacts available for field wiring.

4. Control Module:
   a. Operate notification devices.
   b. Operate solenoids for use in sprinkler service.

E. System Smoke Detectors

1. General Requirements for System Smoke Detectors:
   a. Comply with UL 268; operating at 24-V dc, nominal.
   b. Detectors shall be two-wire type.
   c. 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.
   d. Self-Restoring: Detectors do not require resetting or readjustment after actuation to restore them to normal operation.
   e. Integral Visual-Indicating Light: LED type, indicating detector has operated and power-on status.
      1) Rate-of-rise temperature characteristic of combination smoke- and heat-detection units shall be selectable at fire-alarm control unit for 15 or 20 deg F per minute.
      2) Fixed-temperature sensing characteristic of combination smoke- and heat-detection units shall be independent of rate-of-rise sensing and shall be settable at fire-alarm control unit to operate at 135 or 155 deg F.
      3) Multiple levels of detection sensitivity for each sensor.
      4) Sensitivity levels based on time of day.

2. Photoelectric Smoke Detectors:
   a. 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.
   b. An operator at fire-alarm control unit, having the designated access level, shall be able to manually access the following for each detector:
      1) Primary status.
      2) Device type.
      3) Present average value.
      4) Present sensitivity selected.
      5) Sensor range (normal, dirty, etc.).

3. Duct Smoke Detectors: Photoelectric type complying with UL 268A.
   a. 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.
   b. An operator at fire-alarm control unit, having the designated access level, shall be able to manually access the following for each detector:
      1) Primary status.
      2) Device type.
      3) Present average value.
      4) Present sensitivity selected.

5) Sensor range (normal, dirty, etc.).

c. Weatherproof Duct Housing Enclosure: NEMA 250, Type 4X; NRTL listed for use with the supplied detector for smoke detection in HVAC system ducts.

d. Each sensor shall have multiple levels of detection sensitivity.

e. Sampling Tubes: Design and dimensions as recommended by manufacturer for specific duct size, air velocity, and installation conditions where applied.

f. Relay Fan Shutdown: Fully programmable relay rated to interrupt fan motor-control circuit.

F. Carbon Monoxide Detectors

1. General: Carbon monoxide detector listed for connection to fire-alarm system.
   a. Mounting: Adapter plate for outlet box mounting.
   b. Testable by introducing test carbon monoxide into the sensing cell.
   c. Detector shall provide alarm contacts and trouble contacts.
   d. Detector shall send trouble alarm when nearing end-of-life, power supply problems, or internal faults.
   e. Comply with UL 2075.
   f. Locate, mount, and wire according to manufacturer's written instructions.
   g. Provide means for addressable connection to fire-alarm system.
   h. Test button simulates an alarm condition.

G. Multicriteria Detectors

1. Mounting: Adapter plate for outlet box 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.
3. Automatically adjusts its sensitivity by means of drift compensation and smoothing algorithms. The detector shall send trouble alarm if it is incapable of compensating for existing conditions.
4. Test button tests all sensors in the detector.
5. 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 sensitivity selected.
   d. Sensor range (normal, dirty, etc.).

6. Sensors: The detector shall be comprised of four sensing elements including a smoke sensor, a carbon monoxide sensor, an infrared sensor, and a heat sensor.
   a. Smoke sensor shall be photoelectric type as described in "System Smoke Detectors" Article.
   b. Carbon monoxide sensor shall be as described in "Carbon Monoxide Detectors" Article.
   c. Heat sensor shall be as described in "Heat Detectors" Article.
   d. Each sensor shall be separately listed according to requirements for its detector type.

H. Heat Detectors

1. General Requirements for Heat Detectors: Comply with UL 521.
   a. Temperature sensors shall test for and communicate the sensitivity range of the device.

2. Heat Detector, Combination Type: Actuated by either a fixed temperature of 135 deg F or a rate of rise that exceeds 15 deg F per minute unless otherwise indicated.
   a. Mounting: Adapter plate for outlet box mounting Twist-lock base interchangeable with smoke-detector bases.
   b. Integral Addressable Module: Arranged to communicate detector status (normal, alarm, or trouble) to fire-alarm control unit.

I. Magnetic Door Holders

1. Description: Units are equipped for wall or floor mounting as indicated and are complete with matching doorplate.
   a. Electromagnets: Require no more than 3 W to develop 25-lbfholding force.
   b. Wall-Mounted Units: Flush mounted unless otherwise indicated.
   c. Rating: 24-V ac or dc. Rating: 120-V ac.

2. Material and Finish: Match door hardware.

J. Remote Annunciator

1. 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.
   a. Mounting**:** Flush cabinet, NEMA 250, Type 1.

2. 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.

2.5 DIGITAL ALARM COMMUNICATOR TRANSMITTER

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

B. Functional Performance: Unit shall receive an alarm, supervisory, or trouble signal from fire-alarm control unit and automatically capture two 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. Secondary Power: Integral rechargeable battery and automatic charger.

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

2.6 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 for connection to building automation system.

2.7 DEVICE GUARDS

A. 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.

2.8 FIRE ALARM CABLE

A. Furnish only wire recommended by the fire alarm system manufacturer. Coordinate closely with equipment vendor for quantity, type, and size of fire alarm cables required.

B. Network Riser Cable: Utilize MI type cable, 2-hour fire resistive rating. Applies to all wiring between fire alarm control panels (FACP) and between control panels and notification appliance cabinets (NAC).

C. SLC Circuit Cable for Addressable Initiation Devices: Power-limited (FPLP) solid or stranded (7 strand minimum) copper, 75 Degrees C insulation, #18 AWG twisted, shielded or unshielded, color-coded vinyl insulation, PVC jacket.

D. NAC Circuit Cable for Notification Devices: Power-limited (FPLP), solid or stranded (7 strand minimum) copper, 75 Degrees C insulation, #14 AWG twisted, shielded or unshielded, color-coded vinyl insulation, PVC jacket.

E. 600V THHN shall be suitable for use with SLC and NAC circuits, #18 AWG and #14 AWG, respectively.

F. All wiring shall be color coded and labeled at each end. Splicing by way of wire nuts is prohibited.

G. All fire alarm wiring shall be plenum rated where located in air plenum.

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

C. Manual Fire-Alarm Boxes:

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

D. 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.

E. Install a cover on each smoke detector that is not placed in service during construction. Cover shall remain in place except during system testing. Remove cover prior to system turnover.

F. 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.

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

H. 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.

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

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

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

3.3 PATHWAYS

A. Fire alarm cable shall be installed in raceway.

B. Where approved for use, THHN shall be installed in raceway.

C. Exposed fire alarm raceways shall be painted red enamel.

3.4 CONNECTIONS

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

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

B. Make addressable connections with a supervised interface device to the following devices and systems. Install the interface device less than 36 inches from the device controlled. Make an addressable confirmation connection when such feedback is available at the device or system being controlled.
1. Smoke dampers in air ducts of designated HVAC duct systems.
2. Magnetically held-open doors.
3. Electronically locked doors and access gates.
4. Alarm-initiating connection to elevator recall system and components.
5. Alarm-initiating connection to activate emergency lighting control.
6. Alarm-initiating connection to activate emergency shutoffs for gas and fuel supplies.
7. Supervisory connections at valve supervisory switches.
8. Supervisory connections at elevator shunt-trip breaker.
9. Data communication circuits for connection to building management system.

3.5 IDENTIFICATION

A. Identify system components, wiring, cabling, and terminals. Comply with requirements for identification specified in Section 260553 "Identification for Electrical Systems."

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

3.6 GROUNDING

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

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

3.7 FIELD QUALITY CONTROL

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

B. Manufacturer's Field Service: Engage a factory-authorized service representative to test and inspect components, assemblies, and equipment installations, including connections.

C. Perform tests and inspections.

D. Perform the following tests and inspections with the assistance of a factory-authorized service representative:

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

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

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 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.

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.

3.8 MAINTENANCE SERVICE

A. Initial Maintenance Service: Beginning at Substantial Completion, maintenance service shall include TWELVE months' full maintenance by 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.

3.9 SOFTWARE SERVICE AGREEMENT

A. Comply with UL 864.

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

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

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

3.10 DEMONSTRATION

A. Engage a factory-authorized service representative to train**,** Owner's maintenance personnel to adjust, operate, and maintain fire-alarm system.

END OF SECTION 28 31 11