PROJECT MANUAL

PROJECT:

WYLIE ELEMENTARY SCHOOL – TECHNOLOGY
3060 Kensington Road
Dexter MI 48130

DEXTER HIGH SCHOOL – TECHNOLOGY
2200 N. Parker Road
Dexter, MI 48130

DEXTER HIGH SCHOOL FIELD HOUSE – TECHNOLOGY
2200 N. Parker Road
Dexter, MI 48130

OWNER:

DEXTER COMMUNITY SCHOOL DISTRICT
2704 Baker Road
Dexter, MI 48130

TMP PROJECT NO.: 25023D, 25026D, 29026E

DATE: May 4, 2026

ISSUED FOR: CONSTRUCTION DOCUMENTS

ARCHITECT

TMP ARCHITECTURE, INC.
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TECHNOLOGY CONSULTANT

COMMTECH DESIGN, INC.
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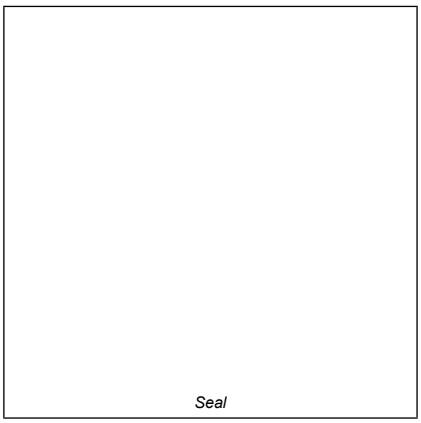
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Wylie Elementary School; Dexter High School; Dexter Field House - Technology

TMP 25023D, 25026D, 25026E

This Document has been prepared under the supervision of the Architect and/or Professional Engineer as indicated by their individual License Seals affixed hereon.

Professional License Seals



TMP Architecture, Inc.
Architect

TABLE OF CONTENTS

PROCUREMENT AND CONTRACTING REQUIREMENTS GROUP

DIVISION 00 – PROCUREMENT AND CONTRACTING REQUIREMENTS

Section	Title	Issued
00 0101	Title Page	**CD**
00 0107	Professional Seals Page	**CD**
00 0110	Table of Contents	**CD**
00 0115	List of Drawings	**CD**
00 8200	Availability of Electronic Files	**CD**
00 8200.01	Electronic Files Release Form	**CD**

SPECIFICATIONS GROUP

GENERAL REQUIREMENTS SUBGROUP

DIVISION 01 - GENERAL REQUIREMENTS

Section	Title	Issued
01 0005	Related Requirements	**CD**
01 2500	Substitution Procedures	**CD**
01 2500.01	TMP Substitution Request Form	**CD**
01 3000	Administrative Requirements	**CD**
01 3000.01	TMP Submittal Form	**CD**
01 4000	Quality Requirements	**CD**
01 4100	Regulatory Requirements	**CD**
01 4216	Definitions	**CD**
01 4219	Reference Standards	**CD**
01 4533	Code-Required Special Inspections and Procedures	**CD**
01 6000	Product Requirements	**CD**
01 7000	Execution and Closeout Requirements	**CD**
01 7800	Closeout Submittals	**CD**
01 7900	Demonstration and Training	**CD**

FACILITY CONSTRUCTION SUBGROUP

DIVISION 02 – EXISTING CONDITIONS

Not Used

DIVISION 03 - CONCRETE

Not Used

DIVISION 04 - MASONRY

Not Used

DIVISION 05 - METALS

Not Used

DIVISION 06 – WOOD, PLASTICS, AND COMPOSITES

Not Used

DIVISION 07 - THERMAL AND MOISTURE PROTECTION

Not Used

DIVISION 08 - OPENINGS

Not Used

DIVISION 09 - FINISHES

Not Used

DIVISION 10 - SPECIALTIES

Not Used

DIVISION 11 - EQUIPMENT

Not Used

DIVISION 12 - FURNISHINGS

Not Used

DIVISION 13 - SPECIAL CONSTRUCTION

Not Used

DIVISION 14 - CONVEYING EQUIPMENT

Not Used

FACILITY SERVICES SUBGROUP

DIVISION 20 – COMMON MECHANICAL REQUIREMENTS

Not Used

DIVISION 21 – FIRE SUPPRESSION

Not Used

DIVISION 22 - PLUMBING

Not Used

DIVISION 23 – HEATING VENTILATING AND AIR CONDITIONING (HVAC)

Not Used

DIVISION 25 – INTEGRATED AUTOMATION

Not Used

DIVISION 26 – ELECTRICAL

Not Used

DIVISION 27 – COMMUNICATIONS

Not Used

DIVISION 28 – ELECTRONIC SAFETY AND SECURITY

Section	Title	Issued
28 1000	Technology Overview	**CD**
28 1100	Communications Room	**CD**
28 1150	Communications Grounding	**CD**
28 1500	Fiber Cabling	**CD**
28 1600	Cat-6 Cabling	**CD**
28 1705	Clock Systems -IP	**CD**
28 1810	Paging IP-System	**CD**
28 3500	Access Control	**CD**
28 3600	Security Recording	**CD**
28 3700	Security Cameras	**CD**
28 5000	AV System Integration	**CD**
28 5350	Classroom Audio	**CD**
28 5400	Video Equipment	**CD**
28 5401	Flat Panel Video Displays	**CD**

28 5450	Audio Equipment	**CD**
28 5453	Audio Speakers	**CD**
28 5470	AV Cabling	**CD**
28 7200	Technology Submittals	**CD**
28 7600	Technology Labeling	**CD**
28 7700	Technology Testing	**CD**
28 7750	Technology Training	**CD**
28 7800	Technology Warranty	**CD**

SITE AND INFRASTRUCTURE SUBGROUP

DIVISION 31 – EARTHWORK

Not Used

DIVISION 32 – EXTERIOR IMPROVEMENTS

Not Used

DIVISION 33 – UTILITIES

Not Used

END OF SECTION

SECTION 00 0115 - LIST OF DRAWINGS

LIST OF DRAWINGS

1.01 GENERAL

A. Drawings: Drawings consist of the Contract Drawings including drawings listed on the TITLE SHEET page of the separately bound drawing set titled Wylie Elementary School - Technology, Dexter High School - Technology, Dexter Field House - Technology, dated May 4, 2026 and any subsequent Addenda and Contract modifications which may occur.

END OF SECTION 00 0115

SECTION 00 8200.01 - TMP ELECTRONIC FILE RELEASE FORM

.

RE: AUTHORIZATION FORM FOR CAD FILE TRANSFERS
PROJECT NAME: WYLIE ELEMENTARY SCHOOL, DEXTER HIGH SCHOOL, DEXTER FIELD HOIUSE - TECHNOLOGY
TMP PROJECT NO.: 25023D, 25026D, 25026E DESIGN RELEASE NO. 1

DEAR SIR/MADAM:

A. Per your request, TMP Architecture, Inc. will electronically transmit requested CAD files upon receipt of an original signed copy of this form which states the conditions of agreement and the receipt of the required compensation fee.
B. By acceptance it is understood and agreed that the data and medium being supplied is to be used only for the project referenced.
C. It is further understood and agreed that the undersigned will hold TMP Architecture, Inc. and its Consultants harmless and indemnify TMP Architecture, Inc. and its Consultants from all claims, liabilities, losses, and so forth, including attorney's fees arising out of the use or misuse of the transferred files.
D. It is understood and agreed that the items transmitted are prepared from CAD files current at the time of preparation. All files are [AutoCAD version 2018 dwg files].
E. This information does not waive the need to verify and review current field conditions and the status of Addenda and/or Bulletin documentation.
F. As a record of information to be transmitted, TMP Architecture, Inc. will prepare a duplicate electronic back-up for its record.
G. Compensation for providing this material will be as follows:
    1. Base Fee of [$250] for 1 to 3 Drawings.
    2. Base Fee of [$500] for 4 to 10 Drawings.
H. For each additional Drawing after 10 the fee is [$40] per Drawing.
I. Example: [11 drawings = $540].
J. Payment must be provided along with a signed copy of this form before files will be released. Please remit to [Construction Manager] to be forwarded to the Project Manager at TMP Architecture, Inc. and allow five working days for processing.

FEE: $_____
REQUESTED DRAWINGS: _____
_____
_____

FIRM REQUESTING FILES:

Company: _____
Address: _____
Signed:_____Date: _____
Printed Name / Title: _____
Email: _____

TO BE COMPLETED BY TMP ARCHITECTURE, INC.

Released(signed by): _____TMP Architecture, Inc.

Printed Name/Title:_____ Date: _____

END OF SECTION 00 8200.01

SECTION 00 8200 - AVAILABILITY OF ELECTRONIC FILES

AVAILABILITY OF ELECTRONIC FILES

1.01 POLICY

A. As a service to Contractor, subcontractors, vendors, material suppliers and others needing electronic copies of Drawings, the Architect will provide CAD files electronically in accordance with the following policy:

1. By acceptance it is understood and agreed that the data and medium being supplied is to be used only for the project referenced.
2. It is further understood and agreed that the undersigned will hold TMP Architecture, Inc. and its Consultants harmless and indemnify TMP Architecture, Inc. and its Consultants from all claims, liabilities, losses, and so forth, including attorney's fees arising out of the use or misuse of the transferred files.
3. It is understood and agreed that the files transmitted are prepared from CAD files current at the time of preparation. All files are AutoCAD version 2018 dwg files.
4. This information does not waive the need to verify and review current field conditions and the status of Addenda and/or Bulletin documentation.
5. As a record of information to be transmitted, TMP Architecture, Inc. will prepare a duplicate electronic back-up for its record.
6. Compensation Fee for providing this material will be as follows:
   a. Base Fee of $250 for 1 to 3 Drawings.
   b. Base Fee of $500 for 4 to 10 Drawings.
   c. For each additional Drawing after 10, the fee is $40 per Drawing.
      1) Example: 11 Drawings = $540.
7. A signed copy of the Release Form and Fee must be provided before files will be released.

1.02 REQUEST PROCEDURE

A. To receive Drawing CAD files the Release Form must be completed in full and submitted to the Construction Manager to be forwarded to the Project Manager at TMP Architecture, Inc.

1. A signed copy of the Release Form must be submitted.
   a. Faxed or emailed copies will be accepted.
2. Upon remittance of the signed Release Form and Fee, allow five working days for processing.
3. Transmission of Drawings will be provided electronically after the receipt of Fee.

1.03 RELEASE FORM

A. Release Form is located immediately after this Section. Refer to Section 00 8200.01 Electronic Files Release Form.

END OF SECTION 00 8200

SECTION 01 0005 - RELATED REQUIREMENTS

PART 1 GENERAL

1.01 DIVISION 00 AND DIVISION 01

A. Unless otherwise noted, all provisions of sections and documents in Division 00 and Division 01, including, but not limited to, General Conditions and Supplementary Conditions, relate and apply to all sections and documents within Project Manual; including, but not limited to, sections and documents in Division 00 through Division 48.

1.02 DRAWINGS

A. Unless otherwise noted, Drawings relate and apply to all specification sections and documents within Project Manual; including, but not limited to, sections and documents in Division 00 through Division 48.

PART 2 PRODUCTS -- NOT USED

PART 3 EXECUTION -- NOT USED

END OF SECTION 01 0005

SECTION 01 2500.01 - TMP SUBSTITUTION REQUEST FORM

SUBSTITUTION REQUEST NUMBER: _____ DATE SUBMITTED: _____
TMP PROJECT NUMBER 25023D, 25026D, 25026E PROJECT NAME: WYLIE ELEMENTARY SCHOOL, DEXTER HIGH SCHOOL, DEXTER FIELD HOUSE - TECHNOLOGY

SPECIFIED ITEM

SPECIFICATION TITLE:_____
SPECIFICATION SECTION_____SPECIFICATION ARTICLE/PARAGRAPH: _____
SPECIFIED PRODUCT / DESCRIPTION: _____
SPECIFIED MANUFACTURER: _____
SPECIFIED PRODUCT / MODEL: _____
REASON SPECIFIED ITEM CANNOT BE PROVIDED: _____
_____
_____

PROPOSED SUBSTITUTION

DESCRIPTION OF PROPOSED SUBSTITUTION: _____
_____
PROPOSED MANUFACTURER: _____
ADDRESS: _____
WEBSITE: _____
PRODUCT / MODEL: _____
YEARS PRODUCT/MODEL HAS BEEN MANUFACTURED: _____
DIFFERENCES BETWEEN PROPOSED SUBSTITUTION AND SPECIFIED ITEM: _____
_____
_____
_____
_____
WILL PROPOSED SUBSTITUTION AFFECT OTHER PARTS OF WORK? ☐ NO ☐ YES
IF YES, EXPLAIN HOW: _____
_____
_____
_____
HOW WILL SUBSTITUTION BENEFIT THE OWNER: ☐ COST SAVINGS ☐ TIME SAVINGS ☐ OTHER
PROVIDE SPECIFIC DETAILS: _____
_____
_____
_____

THE FOLLOWING INFORMATION IS REQUIRED; CHECK TO INDICATE INFORMATION IS ATTACHED. (REQUEST WILL BE REJECTED WITHOUT REQUIRED DATA)

32.01

A. ☐ List of references where proposed product has been installed; include address, owner, architect, and date installed.
B. ☐ Product data sheets.

C. ☐ Applicable certificates and test reports.
D. ☐ Comparative Data: Provide point-by-point, side-by-side comparison of specified product and proposed substitution addressing essential attributes specified.

INDICATE WHICH OF THE FOLLOWING VOLUNTARY INFORMATION IS ATTACHED, IF ANY:
☐ DRAWINGS.
☐ SAMPLES.
☐ OTHER ITEMS: _____

SIGNATURE

THE UNDERSIGNED CERTIFIES:

The proposed substitution meets or exceeds the quality level of the specified product, equipment, assembly, or system.
To provide the same warranty for the substitution as for the specified product.
Agrees to provide same or equivalent maintenance service and source of replacement parts, as applicable.
Agrees to coordinate installation and make changes to other work that may be required for the work to be complete, with no additional cost to Owner.
The proposed substitution will have no adverse effects on other work.
The proposed substitution will not affect project schedule.
Waives claims for additional costs or time extension that may subsequently become apparent.

CONTRACTOR / COMPANY: _____
SIGNED BY: _____PRINTED NAME: _____
TITLE: _____
ADDRESS: _____
EMAIL: _____ PHONE: _____

ARCHITECT'S RESPONSE

A. During bidding, Architect will approve substitution requests by issuing an Addendum. Substitutions not approved by addendum are rejected.
B. During construction, Architect will notify Contractor in writing (see below) of decision to accept or reject request, and incorporate the substitution into the project by Change Order, Construction Change Directive, Architectural Supplementary Instructions, or similar instruments as provided for in the Conditions of the Contract.

☐ SUBSTITUTION APPROVED - PROVIDE SUBMITTALS PER SECTION 01 3000 AND RESPECTIVE SECTION FOR WHICH SUBSTITUTION WAS MADE.
☐ SUBSTITUTION REJECTED - PROVIDE SPECIFIED MATERIALS.

SIGNED BY: _____PRINTED NAME: _____
ARCHITECT'S COMMENTS: _____
_____
_____

END OF SECTION 01 2500.01

SECTION 01 2500 - SUBSTITUTION PROCEDURES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Procedural requirements for proposed substitutions.

1.02 RELATED REQUIREMENTS

A. Section 01 2500.01 - TMP Substitution Request Form.

1.03 DEFINITIONS

A. Substitutions: Changes from Contract Documents requirements proposed by Contractor to materials, products, assemblies, and equipment.
   1. Substitutions for Cause: Proposed due to changed Project circumstances beyond Contractor's control.
   2. Substitutions for Convenience: Proposed due to possibility of offering substantial advantage to the Project.

B. Substitutions: Any proposed substitution to be evaluated by the Architect and accepted as stipulated below.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.01 GENERAL REQUIREMENTS

A. A Substitution Request for products, assemblies, materials, and equipment constitutes a representation that the submitter:
   1. Has investigated proposed product and determined that it meets or exceeds the quality level of the specified product, equipment, assembly, or system.
   2. Agrees to provide the same warranty for the substitution as for the specified product.
   3. Agrees to provide same or equivalent maintenance service and source of replacement parts, as applicable.
   4. Agrees to coordinate installation and make changes to other work that may be required for the work to be complete, with no additional cost to Owner.
   5. Waives claims for additional costs or time extension that may subsequently become apparent.

B. Document each request with complete data substantiating compliance of proposed substitution with Contract Documents. Burden of proof is on proposer.
   1. Note explicitly any non-compliant characteristics.

C. Content: Include information necessary for tracking the status of each Substitution Request, and information necessary to provide an actionable response.
   1. Forms included in the Project Manual are adequate for this purpose, and must be used.

D. Limit each request to a single proposed substitution item.
   1. Submit an electronic document, combining the request form with supporting data into single document.

3.02 SUBSTITUTION PROCEDURES DURING PROCUREMENT

A. Submittal Time Restrictions:

B. Substitution Request Form: TMP Substitution Request Form must be completed and provided at the beginning of each substitution request.
   1. Refer to Section 01 2500.01 - TMP Substitution Request Form.
   2. Submittals without a completed TMP Substitution Request Form will not be acknowledged, reviewed, or returned. Use only this form; other forms of submission are unacceptable.

C. Instructions to Bidders specifies time restrictions for submitting requests for substitutions during the bidding period.

3.03 SUBSTITUTION PROCEDURES DURING CONSTRUCTION

A. Substitution Request Form: TMP Substitution Request Form must be completed and provided at the beginning of each substitution request.
   1. Refer to Section 01 2500.01 - TMP Substitution Request Form.
   2. Submittals without a completed TMP Substitution Request Form will not be acknowledged, reviewed, or returned. Use only this form; other forms of submission are unacceptable.

B. Submit request for Substitution for Cause immediately upon discovery of need for substitution, but not later than 14 days prior to time required for review and approval by Architect, in order to stay on approved project schedule.

C. Submit request for Substitution for Convenience within 14 days of discovery of its potential advantage to the project, but not later than 14 days prior to time required for review and approval by Architect, in order to stay on approved project schedule.
   1. In addition to meeting general documentation requirements, document how the requested substitution benefits the Owner through cost savings, time savings, greater energy conservation, or in other specific ways.
   2. Document means of coordinating of substitution item with other portions of the work, including work by affected subcontractors.
   3. Bear the costs engendered by proposed substitution of:
      a. Owner's compensation to the Architect for any required redesign, time spent processing and evaluating the request.
      b. Other unanticipated project considerations.

D. Substitutions will not be considered under one or more of the following circumstances:
   1. When they are indicated or implied on shop drawing or product data submittals, without having received prior approval.
   2. Without a separate written request.

3.04 RESOLUTION

A. Architect may request additional information and documentation prior to rendering a decision. Provide this data in an expeditious manner.

B. Architect will notify Contractor in writing of decision to accept or reject request.
   1. During construction, Architect's decision following review of proposed substitution will be noted on the submitted form.
   2. During bidding, Architect will approve substitution requests by issuing an Addendum. Substitutions not approved by addendum are rejected.

3.05 ACCEPTANCE

A. Accepted substitutions change the work of the Project. They will be documented and incorporated into work of the project by Change Order, Construction Change Directive, Architectural Supplementary Instructions, or similar instruments provided for in the Conditions of the Contract.

3.06 CLOSEOUT ACTIVITIES

A. See Section 01 7800 - Closeout Submittals, for closeout submittals.

END OF SECTION 01 2500

SUBMITTAL AND SAMPLE TRANSMITTAL FORM

01 3000.01

CONST. MANAGER / CONTRACTOR	PROJECT	TMP PROJECT NO.	DATE SUBMITTED	SUBMITTAL NO.
Name and Address:	Title:	25023D, 25026D, 25026E		
	Wylie Elementary School, Dexter High School, Dexter Field House - Technology	* ACTION CODES		Initial Submittal ☐ Resubmittal ☐
Email:	Location:	R Reviewed – No Exceptions Taken RN Reviewed with Corrections Noted RR Revise and Resubmit X Not Approved – Resubmit NA No Action Taken – Not Reviewed		REVIEWED BY
	3060 Kensington Road Dexter, MI 48130			TMP ☐ Consultant ☐
Phone:	2200 N. Parker Road, Dexter, MI 48130			Reviewer:

SPECIFICATION SECTION NO.	SUBCONTRACTOR / MANUFACTURER	ITEM DESCRIPTION	NO. OF SAMPLES	NO. OF SAMPLES RETURNED	ACTION CODE *	DATE REVIEWED	DATE RETURNED
Transmittal shall be for one specification section only; do not submit items from multiple sections under the same transmittal. Multi-section submittals will be returned; stamped "X - Not Approved - Resubmit"							

Submittal Stamps may be placed on subsequent blank page.

CONTRACTOR COMMENTS	ARCHITECT COMMENTS	The undersigned certifies that the above submitted items have been reviewed in detail and are correct and in strict conformance with the Contract Documents except as otherwise noted. NOTE: Approval of items submitted does not relieve Contractor from complying with all requirements of the Contract Documents.
		CONTRACTOR NAME
		SIGNATURE

This page intentionally left blank for Submittal Stamps

SECTION 01 3000 - ADMINISTRATIVE REQUIREMENTS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Submittals for review, information, and project closeout.
B. Number of copies of submittals.
C. Requests for Interpretation (RFI) procedures.
D. Submittal procedures.

1.02 RELATED REQUIREMENTS

A. Section 01 3000.01 - TMP Submittal and Sample Transmittal Form.

1.03 REFERENCE STANDARDS

A. AIA G716 - Request for Information; 2004.
B. CSI/CSC Form 13.2A - Request for Information; Current Edition.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.01 REQUESTS FOR INTERPRETATION (RFI)

A. Definition: A request seeking one of the following:
   1. An interpretation, amplification, or clarification of some requirement of Contract Documents arising from inability to determine from them the exact material, process, or system to be installed; or when the elements of construction are required to occupy the same space (interference); or when an item of work is described differently at more than one place in Contract Documents.
   2. A resolution to an issue which has arisen due to field conditions and affects design intent.
B. Preparation: Prepare an RFI immediately upon discovery of a need for interpretation of Contract Documents. Failure to submit a RFI in a timely manner is not a legitimate cause for claiming additional costs or delays in execution of the work.
   1. Prepare a separate RFI for each specific item.
      a. Review, coordinate, and comment on requests originating with subcontractors and/or materials suppliers.
      b. Do not forward requests which solely require internal coordination between subcontractors.
   2. Prepare in a format and with content acceptable to Architect. Use one of the following:
      a. Use AIA G716 - Request for Information .
      b. Use CSI/CSC Form 13.2A - Request for Interpretation.
      c. Other format acceptable to Architect.
   3. Combine RFI and its attachments into a single electronic file. PDF format is preferred.
   4. Submit RFIs through Procore, email, or other approved method agreed to by the Architect and Owner.
      a. RFIs submitted via an internet-based submittal service are to send electronic documents to the Architect via email with a downloadable link.
C. Reason for the RFI: Prior to initiation of an RFI, carefully study all Contract Documents to confirm that information sufficient for their interpretation is definitely not included.
   1. Include in each request Contractor's signature attesting to good faith effort to determine from Contract Documents information requiring interpretation.
   2. Improper RFIs: Requests not prepared in conformance to requirements of this section, and/or missing key information required to render an actionable response. They will be returned without a response and may include an explanatory notation.
   3. Frivolous RFIs: Requests regarding information that is clearly indicated on, or reasonably inferable from, the Contract Documents, with no additional input required to clarify the question. They will be returned without a response and may include an explanatory notation.

a. The Owner reserves the right to assess the Contractor for the costs (on time-and-materials basis) incurred by the Architect, and any of its consultants, due to processing of such RFIs.

D. Content: Include identifiers necessary for tracking the status of each RFI, and information necessary to provide an actionable response.
1. Official Project name and number, and any additional required identifiers established in Contract Documents.
2. Discrete and consecutive RFI number, and descriptive subject/title.
3. Issue date, and requested reply date.
4. Reference to particular Contract Document(s) requiring additional information/interpretation. Identify pertinent drawing and detail number and/or specification section number, title, and paragraph(s).
5. Annotations: Field dimensions and/or description of conditions which have engendered the request.
6. Contractor's suggested resolution: A written and/or a graphic solution, to scale, is required in cases where clarification of coordination issues is involved, for example; routing, clearances, and/or specific locations of work shown diagrammatically in Contract Documents. If applicable, state the likely impact of the suggested resolution on Contract Time or the Contract Sum.

E. Attachments: Include sketches, coordination drawings, descriptions, photos, submittals, and other information necessary to substantiate the reason for the request.

F. RFI Log: Prepare and maintain a tabular log of RFIs for the duration of the project.
1. Indicate current status of every RFI. Update log promptly and on a regular basis.
2. Note dates of when each request is made, and when a response is received.
3. Identify and include improper or frivolous RFIs.

G. Review Time: Architect will respond and return RFIs to Contractor within seven calendar days of receipt. For the purpose of establishing the start of the mandated response period, RFIs received after 3:00 PM will be considered as having been received on the following regular working day.
1. Response period may be shortened or lengthened for specific items, subject to mutual agreement, and recorded in a timely manner in progress meeting minutes.

H. Responses: Content of answered RFIs will not constitute in any manner a directive or authorization to perform extra work or delay the project. If in Contractor's belief it is likely to lead to a change to Contract Sum or Contract Time, promptly issue a notice to this effect, and follow up with an appropriate Change Order request to Owner.
1. Response may include a request for additional information, in which case the original RFI will be deemed as having been answered, and an amended one is to be issued forthwith. Identify the amended RFI with an R suffix to the original number.
2. Do not extend applicability of a response to specific item to encompass other similar conditions, unless specifically so noted in the response.
3. Upon receipt of a response, promptly review and distribute it to all affected parties, and update the RFI Log.
4. Notify Architect within seven calendar days if an additional or corrected response is required by submitting an amended version of the original RFI, identified as specified above.

3.02 SUBMITTAL SCHEDULE

A. Submit to Architect for review a schedule for submittals in tabular format.
1. Submit at the same time as the preliminary schedule.
2. Coordinate with Contractor's construction schedule and schedule of values.
3. Format schedule to allow tracking of status of submittals throughout duration of construction.

4. Arrange information to include scheduled date for initial submittal, specification number and title, description of item of work covered, and role and name of subcontractor.
5. Account for time required for preparation, review, manufacturing, fabrication and delivery when establishing submittal delivery and review deadline dates.
   a. For assemblies, equipment, systems comprised of multiple components and/or requiring detailed coordination with other work, allow for additional time to make corrections or revisions to initial submittals, and time for their review.

3.03 SUBMITTALS FOR REVIEW

A. When the following are specified in individual sections, submit them for review:
   1. Product data.
   2. Shop drawings.
   3. Samples for selection.
   4. Samples for verification.
B. Submit to Architect for review for the limited purpose of checking for compliance with information given and the design concept expressed in Contract Documents.
C. Samples will be reviewed for aesthetic, color, or finish selection.
D. After review, provide copies and distribute in accordance with SUBMITTAL PROCEDURES article below and for record documents purposes described in Section 01 7800 - Closeout Submittals.

3.04 SUBMITTALS FOR INFORMATION

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

3.05 SUBMITTALS FOR PROJECT CLOSEOUT

A. Submit Correction Punch List for Substantial Completion.
B. Submit Final Correction Punch List for Substantial Completion.
C. When the following are specified in individual sections, submit them at project closeout in compliance with requirements of Section 01 7800 - Closeout Submittals:
   1. Project record documents.
   2. Operation and maintenance data.
   3. Warranties.
   4. Other types as indicated.
D. Submit for Owner's benefit during and after project completion.

3.06 NUMBER OF COPIES OF SUBMITTALS

A. Electronic Documents: Submit one electronic copy.
B. Samples: Submit the number specified in individual specification sections, but not less than 3; one (minimum) of which will be retained by Architect.
   1. After review, produce duplicates.
   2. Retained samples will not be returned to Contractor unless specifically so stated.

3.07 SUBMITTAL PROCEDURES

A. Transmittal Form: TMP Submittal and Sample Transmittal Form must be completed and provided at the beginning of each submittal.
   1. Refer to Section 01 3000.01 - TMP Submittal and Sample Transmittal Form.

2. Submittals without a completed TMP Submittal and Sample Transmittal Form will not be acknowledged, reviewed, or returned.

B. Submittals shall be submitted in electronic form.
   1. Exceptions: Physical samples.
      a. Physical Samples must be accompanied by an electronic copy and a hard/physical copy of the completed TMP Submittal and Sample Transmittal Form.

C. Electronic Submittals: Comply with the following:
   1. Submittal process shall be through Procore, email, or other approved method agreed to by the Architect and Owner.
      a. Submittals via an internet-based submittal service are to send electronic documents to the Architect via email with a downloadable link.
   2. File Format: Portable Document Format (PDF).
   3. File Naming: File naming shall be in the following format:
      a. Specification section number, followed by a hyphen, and a consecutive number indicating sequential submittals for that section; followed by a general description of the submittal contents.
         1) Examples:
            (a) Section 07 9200; first submittal:
               (1) 07 9200-01 Joint Sealants
            (b) Section 07 9200; second submittal:
               (1) 07 9200-02 Joint Sealant Color
      b. Resubmittals. For revised resubmittals use original number and a sequential combination numerical and alphabetical suffix; hyphen followed by "R" and a two-digit consecutive number indicating sequential resubmittals for that particular submittal.
         1) Examples:
            (a) Section 07 9200; resubmittal of first submittal of section:
               (1) 07 9200-01-R01 Joint Sealants.
            (b) Section 07 9200; second resubmittal of first submittal of section:
               (1) 07 9200-01-R02 Joint Sealants
            (c) Section 07 9200; first resubmittal of second submittal of section:
               (1) 07 9200-02-R01 Joint Sealant Color
   4. Each Submittal shall be one file, complete with all attachments.
      a. Multi-file submittal will not be acknowledged, reviewed, or returned.

D. General Requirements:
   1. Use a single transmittal for related items.
      a. Each transmittal shall be for one specification section only; do not submit items for multiple sections under the same transmittal.
         1) Multi-section submittals will be acknowledged and returned; stamped "X - Not Approved - Resubmit".
   2. Submit separate packages of submittals for review and submittals for information, when included in the same specification section.
   3. Apply Contractor's stamp, signed or initialed certifying that review, approval, verification of products required, field dimensions, adjacent construction work, and coordination of information is in accordance with the requirements of the work and Contract Documents.
      a. Submittals from sources other than the Contractor, or without Contractor's stamp will not be acknowledged, reviewed, or returned.
   4. Deliver each submittal on date noted in submittal schedule, unless an earlier date has been agreed to by all affected parties, and is of the benefit to the project.
   5. Schedule submittals to expedite the Project, and coordinate submission of related items.
      a. For each submittal for review, allow 14 calendar days excluding delivery time to and from the Contractor.
      b. For sequential reviews involving Architect's consultants, Owner, or another affected party, allow an additional 7 calendardays.

6. Identify variations from Contract Documents and product or system limitations that may be detrimental to successful performance of the completed work.
7. When revised for resubmission, identify all changes made since previous submission.
8. Distribute reviewed submittals. Instruct parties to promptly report inability to comply with requirements.
9. Incomplete submittals will not be reviewed, unless they are partial submittals for distinct portion(s) of the work, and have received prior approval for their use.
10. Submittals not requested will be recognized and returned; stamped "NA - No Action Taken - Not Reviewed"

E. Product Data Procedures:
1. Submit only information required by individual specification sections.
2. Collect required information into a single submittal.
3. Submit concurrently with related shop drawing submittal.
4. Do not submit (Material) Safety Data Sheets for materials or products unless specifically called for in individual sections.

F. Shop Drawing Procedures:
1. Prepare accurate, drawn-to-scale, original shop drawing documentation by interpreting Contract Documents and coordinating related work.
2. Do not reproduce Contract Documents to create shop drawings.
3. Generic, non-project-specific information submitted as shop drawings do not meet the requirements for shop drawings.
4. Non-complying submittals will be acknowledged and returned; stamped "X - Not Approved - Resubmit".

G. Samples Procedures:
1. Transmit related items together as single package.
2. Identify each item to allow review for applicability in relation to shop drawings showing installation locations.
3. Submit actual physical samples.
4. Electronic submittals will not be accepted unless prior approval is received from the Architect. Electronic samples without prior approval will be acknowledged and returned; stamped "X - Not Approved - Resubmit."

3.08 SUBMITTAL REVIEW

A. General: Submittals that do not conform to the requirements of this section will not be acknowledged, reviewed, or returned.

B. Submittals for Review: Architect will review each submittal, and approve, or take other appropriate action.

C. Submittals for Information: Architect will acknowledge and may review. See below for actions to be taken.

D. Architect's actions will be reflected by marking each returned submittal using virtual stamp on electronic submittals.
1. Where more than one action has been indicated, each shall apply to that portion of the submittal for which the action is indicated.

E. Architect's review shall not indicate approval of dimensions, quantities or fabrication processes unless specific notations are made by the Architect regarding same.

F. Architect's and consultants' actions on items submitted for review:
1. Authorizing purchasing, fabrication, delivery, and installation:
a. "Reviewed - No Exceptions Taken", "Approved", or language with same legal meaning.
b. "Reviewed with Corrections Noted", "Approved as Noted, Resubmission not required", or language with same legal meaning.
1) At Contractor's option, submit corrected item, with review notations acknowledged and incorporated.

2. Not Authorizing fabrication, delivery, and installation:
   a. "Revise and Resubmit", "Not Approved - Resubmit", or language with the same legal meaning.
      1) Resubmit revised item, with review notations acknowledged and incorporated.
3. Not Authorizing manufacturer:
   a. Rejected - Resubmit, or language with the same legal meaning.

G. Architect's and consultants' actions on items submitted for information:
1. Items for which no action was taken:
   a. "No Action Taken - Not Reviewed" or "Received" - to notify the Contractor that the submittal has been received for record only.

END OF SECTION 01 3000

SECTION 01 4000 - QUALITY REQUIREMENTS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Submittals.
B. Quality assurance.
C. References and standards.
D. Testing and inspection agencies and services.
E. Contractor's design-related professional design services.
F. Control of installation.
G. Mock-ups.
H. Tolerances.
I. Manufacturers' field services.
J. Defect Assessment.

1.02 REFERENCE STANDARDS

A. ASTM E329 - Standard Specification for Agencies Engaged in Construction Inspection, Testing, or Special Inspection; 2025b.
B. ASTM E543 - Standard Specification for Agencies Performing Nondestructive Testing; 2026.
C. ASTM E699 - Standard Specification for Agencies Involved in Testing, Quality Assurance, and Evaluating of Manufactured Building Components; 2016.

1.03 DEFINITIONS

A. Contractor's Professional Design Services: Design of some aspect or portion of the project by party other than the design professional of record. Provide these services as part of the Contract for Construction.
    1. Design Services Types Required:
        a. Design-Related: Design services explicitly required to be performed by another design professional due to highly-technical and/or specialized nature of a portion of the project. Services primarily involve engineering analysis, calculations, and design, and are not intended to alter the aesthetic aspects of the design.
B. Design Data: Design-related, signed and sealed drawings, calculations, specifications, certifications, shop drawings and other submittals provided by Contractor, and prepared directly by, or under direct supervision of, appropriately licensed design professional.

1.04 CONTRACTOR'S DESIGN-RELATED PROFESSIONAL DESIGN SERVICES

A. Coordination: Contractor's professional design services are subject to requirements of project's Conditions for Construction Contract.
B. Base design on performance and/or design criteria indicated in individual specification sections.

1.05 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
B. Design Data: Submit for Architect's knowledge as contract administrator for the limited purpose of assessing compliance with information given and the design concept expressed in the Contract Documents, or for Owner's information.
    1. Include a statement or certification attesting that design data complies with criteria indicated, such as building codes, loads, functional, and similar engineering requirements.
    2. Include signature and seal of design professional responsible for allocated design services on calculations and drawings.
C. Test Reports: After each test/inspection, promptly submit 1 copies of report to Architect and to Contractor.
    1. Include:

a. Date issued.
b. Project title and number.
c. Name of inspector.
d. Date and time of sampling or inspection.
e. Identification of product and specifications section.
f. Location in the Project.
g. Type of test/inspection.
h. Date of test/inspection.
i. Results of test/inspection.
j. Compliance with Contract Documents.
k. When requested by Architect, provide interpretation of results.

2. Test report submittals are for Architect's knowledge as contract administrator for the limited purpose of assessing compliance with information given and the design concept expressed in the Contract Documents, or for Owner's information.

D. Certificates: When specified in individual specification sections, submit certification by the manufacturer and Contractor or installation/application subcontractor to Architect, in quantities specified for Product Data.
1. Indicate material or product complies with or exceeds specified requirements. Submit supporting reference data, affidavits, and certifications as appropriate.
2. Certificates may be recent or previous test results on material or product, but must be acceptable to Architect.

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

F. Manufacturer's Field Reports: Submit reports for Architect's benefit as contract administrator or for Owner.
1. Submit for information for the limited purpose of assessing compliance with information given and the design concept expressed in the Contract Documents.

1.06 QUALITY ASSURANCE

A. Testing Agency Qualifications:
1. Prior to start of Work, submit agency name, address, and telephone number, and names of full time specialist and responsible officer.

B. Designer Qualifications: Where professional engineering design services and design data submittals are specifically required of Contractor by Contract Documents, provide services of a Professional Engineer experienced in design of this type of work and licensed in the State in which the Project is located.

1.07 REFERENCES AND STANDARDS

A. Comply with reference standard of date of issue current on date of Contract Documents, except where a specific date is established by applicable code.

B. Obtain copies of standards where required by product specification sections.

C. Maintain copy at project site during submittals, planning, and progress of the specific work, until Substantial Completion.

1.08 TESTING AND INSPECTION AGENCIES AND SERVICES

A. As indicated in individual specification sections, Owner or Contractor shall employ and pay for services of an independent testing agency to perform other specified testing.

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

C. Contractor Employed Agency:

1. Testing agency: Comply with requirements of ASTM E329, ASTM E543, and ASTM E699.
2. Inspection agency: Comply with requirements of ASTM E329.
3. Laboratory Staff: Maintain a full time specialist on staff to review services.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.01 CONTROL OF INSTALLATION

A. Monitor quality control over suppliers, manufacturers, products, services, site conditions, and workmanship, to produce work of specified quality.
B. Comply with manufacturers' instructions, including each step in sequence.
C. Should manufacturers' instructions conflict with Contract Documents, request clarification from Architect before proceeding.
D. Comply with specified standards as minimum quality for the work except where more stringent tolerances, codes, or specified requirements indicate higher standards or more precise workmanship.
E. Have work performed by persons qualified to produce required and specified quality.
F. Verify that field measurements are as indicated on shop drawings or as instructed by the manufacturer.
G. Secure products in place with positive anchorage devices designed and sized to withstand stresses, vibration, physical distortion, and disfigurement.

3.02 MOCK-UPS

A. Before installing portions of the Work where mock-ups are required, construct mock-ups in location and size indicated for each form of construction and finish required to comply with the following requirements, using materials indicated for the completed Work. The purpose of mock-up is to demonstrate the proposed range of aesthetic effects and workmanship.
B. Accepted mock-ups establish the standard of quality the Architect will use to judge the Work.
C. Integrated Exterior Mock-ups: Construct integrated exterior mock-up as indicated on drawings. Coordinate installation of exterior envelope materials and products as required in individual Specification Sections. Provide adequate supporting structure for mock-up materials as necessary.
D. Notify Architect 5 working days in advance of dates and times when mock-ups will be constructed.
E. Provide supervisory personnel who will oversee mock-up construction. Provide workers that will be employed during the construction at Project.
F. Tests shall be performed under provisions identified in this section and identified in the respective product specification sections.
G. Assemble and erect specified items with specified attachment and anchorage devices, flashings, seals, and finishes.
H. Obtain Architect's approval of mock-ups before starting work, fabrication, or construction.
   1. Make corrections as necessary until Architect's approval is issued.
I. Architect will use accepted mock-ups as a comparison standard for the remaining Work.
J. Where mock-up has been accepted by Architect and is specified in product specification sections to be removed, protect mock-up throughout construction, remove mock-up and clear area when directed to do so by Architect.

3.03 TOLERANCES

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

B. Comply with manufacturers' tolerances. Should manufacturers' tolerances conflict with Contract Documents, request clarification from Architect before proceeding.
C. Adjust products to appropriate dimensions; position before securing products in place.

3.04 TESTING AND INSPECTION

A. See individual specification sections for testing and inspection required.
B. Testing Agency Duties:
   1. Provide qualified personnel at site. Cooperate with Architect and Contractor in performance of services.
   2. Perform specified sampling and testing of products in accordance with specified standards.
   3. Ascertain compliance of materials and mixes with requirements of Contract Documents.
   4. Promptly notify Architect and Contractor of observed irregularities or non-compliance of Work or products.
   5. Perform additional tests and inspections required by Architect.
   6. Submit reports of all tests/inspections specified.
C. Limits on Testing/Inspection Agency Authority:
   1. Agency may not release, revoke, alter, or enlarge on requirements of Contract Documents.
   2. Agency may not approve or accept any portion of the Work.
   3. Agency may not assume any duties of Contractor.
   4. Agency has no authority to stop the Work.
D. Contractor Responsibilities:
   1. Deliver to agency at designated location, adequate samples of materials proposed to be used that require testing, along with proposed mix designs.
   2. Cooperate with laboratory personnel, and provide access to the Work.
   3. Provide incidental labor and facilities:
      a. To provide access to Work to be tested/inspected.
      b. To obtain and handle samples at the site or at source of Products to be tested/inspected.
      c. To facilitate tests/inspections.
      d. To provide storage and curing of test samples.
   4. Notify Architect and laboratory 48 hours prior to expected time for operations requiring testing/inspection services.
   5. Employ services of an independent qualified testing laboratory and pay for additional samples, tests, and inspections required by Contractor beyond specified requirements.
   6. Arrange with Owner's agency and pay for additional samples, tests, and inspections required by Contractor beyond specified requirements.
E. Re-testing required because of non-compliance with specified requirements shall be performed by the same agency on instructions by Architect.
F. Re-testing required because of non-compliance with specified requirements shall be paid for by Contractor.

3.05 MANUFACTURERS' FIELD SERVICES

A. When specified in individual specification sections, require material or product suppliers or manufacturers to provide qualified staff personnel to observe site conditions, conditions of surfaces and installation, quality of workmanship, start-up of equipment, test, adjust, and balance equipment as applicable, and to initiate instructions when necessary.
B. Report observations and site decisions or instructions given to applicators or installers that are supplemental or contrary to manufacturers' written instructions.

3.06 DEFECT ASSESSMENT

A. Replace Work or portions of the Work not complying with specified requirements.

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

END OF SECTION 01 4000

SECTION 01 4100 - REGULATORY REQUIREMENTS

PART 1 GENERAL

1.01 SUMMARY OF REFERENCE STANDARDS

A. Regulatory requirements applicable to this project are the following:
   1. ASHRAE Std 90.1 I-P-2019 - Energy Standard for Buildings Except Low-Rise Residential Buildings; 2019, with Errata and Addenda (2021).
   2. Barrier Free Code: Comply with the following:
      a. Michigan Building Code; 2021.
      b. ICC A117.1 - Accessible and Usable Buildings and Facilities; 2017.
   3. School Fire Safety Rules: Michigan School Fire Safety Rules; 2016.
      a. Includes NFPA 101-2012 - Life Safety Code; 2012, plus amendments.
   4. Building Code: Michigan Building Code; 2021.
   5. Plumbing Code: Michigan Plumbing Code; 2021.
   6. Mechanical Code: Michigan Mechanical Code; 2021.
   7. Electrical Code: NFPA 70 - National Electric Code; 2023.
      a. Includes 2023 Michigan Construction Code - Part 8 Electrical Code Rules.
   8. Elevator Code: Comply with the following:
      a. ASME A17.1 - Safety Code for Elevators and Escalators; 2016.
      b. ASME A18.1- Safety Standard for Platform Lifts and Stairway Chairlifts; 2017.
      c. 2023 Michigan Elevator Safety Board General Rules.
   9. Boiler Code: Michigan Boiler Code.
      a. Includes the following:
         1) ASME Boiler and Pressure Vessel Codes; 2019.
         2) National Board Inspection Code; 2019.
         3) PA 407 Skilled Trades Regulation Act; 2016.
   10. Energy Code: Michigan Commercial Energy Code; 2021.
      a. Includes ASHRAE Std 90.1 I-P-2019 - Energy Standard for Buildings Except Low-Rise Residential Buildings; 2019.
   11. Existing Building Code: Michigan Rehabilitation Code; 2021.

B. Where specification sections reference more current standards or codes, comply with the more restrictive requirements unless notified in writing by Architect.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION - NOT USED

END OF SECTION 01 4100

SECTION 01 4216 - DEFINITIONS

PART 1 GENERAL

1.01 SUMMARY

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

B. Other definitions are included in individual specification sections.

1.02 DEFINITIONS

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

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

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

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

E. Provide: To furnish and install.

F. Supply: Same as Furnish.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION - NOT USED

END OF SECTION 01 4216

SECTION 01 4219 - REFERENCE STANDARDS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Requirements relating to referenced standards.

1.02 QUALITY ASSURANCE

A. For products or workmanship specified by reference to a document or documents not included in the Project Manual, also referred to as reference standards, comply with requirements of the standard, except when more rigid requirements are specified or are required by applicable codes.

B. Comply with the reference standard of date of issue , except where a specific date is established by applicable code.

C. Should specified reference standards conflict with Contract Documents, request clarification from the Architect before proceeding.

D. Neither the contractual relationships, duties, or responsibilities of the parties in Contract nor those of the Architect shall be altered by Contract Documents by mention or inference otherwise in any reference document.

PART 2 PRODUCTS -- NOT USED

PART 3 EXECUTION -- NOT USED

END OF SECTION 01 4219

SECTION 01 4533 - CODE-REQUIRED SPECIAL INSPECTIONS AND PROCEDURES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Code-required special inspections.
B. Submittals.

1.02 ABBREVIATIONS AND ACRONYMS

A. AHJ: Authority having jurisdiction.
B. NIST: National Institute of Standards and Technology.

1.03 DEFINITIONS

A. Code or Building Code: Michigan Building Code; 2021, specifically Chapter 17 - Special Inspections and Tests.
B. Authority Having Jurisdiction (AHJ): Agency or individual officially empowered to enforce the building, fire and life safety code requirements of the permitting jurisdiction in which the Project is located.
C. Special Inspection:
   1. Special inspections are inspections and testing of materials, installation, fabrication, erection or placement of components and connections mandated by the AHJ that also require special expertise to ensure compliance with the approved Contract Documents and the referenced standards.
   2. Special inspections are separate from and independent of tests and inspections conducted by Owner or Contractor for the purposes of quality assurance and contract administration.

1.04 REFERENCE STANDARDS

A. ASTM E329 - Standard Specification for Agencies Engaged in Construction Inspection, Testing, or Special Inspection; 2025b.

1.05 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
B. Special Inspection Agency Qualifications: Prior to the start of work, the Special Inspection Agency is required to:
   1. Submit agency name, address, and telephone number, names of full time specialist and responsible officer.
   2. Submit copy of report of laboratory facilities inspection made by NIST Construction Materials Reference Laboratory during most recent inspection, with memorandum of remedies of any deficiencies reported by the inspection.
   3. Submit certification that Special Inspection Agency is acceptable to AHJ.
C. Special Inspection Reports: After each special inspection, Special Inspector is required to promptly submit at least two copies of report; one to Architect and one to the AHJ.
   1. Include:
      a. Date issued.
      b. Project title and number.
      c. Name of Special Inspector.
      d. Date and time of special inspection.
      e. Identification of product and specifications section.
      f. Location in the Project.
      g. Type of special inspection.
      h. Date of special inspection.
      i. Results of special inspection.
      j. Compliance with Contract Documents.

2. Final Special Inspection Report: Document special inspections and correction of discrepancies prior to the start of the work.

D. Fabricator Special Inspection Reports: After each special inspection of fabricated items at the Fabricator's facility, Special Inspector is required to promptly submit at least two copies of report; one to Architect and one to AHJ.
   1. Include:
      a. Date issued.
      b. Project title and number.
      c. Name of Special Inspector.
      d. Date and time of special inspection.
      e. Identification of fabricated item and specification section.
      f. Location in the Project.
      g. Results of special inspection.
      h. Verification of fabrication and quality control procedures.
      i. Compliance with Contract Documents.
      j. Compliance with referenced standard(s).

E. Test Reports: After each test or inspection, promptly submit at least two copies of report; one to Architect and one to AHJ.
   1. Include:
      a. Date issued.
      b. Project title and number.
      c. Name of inspector.
      d. Date and time of sampling or inspection.
      e. Identification of product and specifications section.
      f. Location in the Project.
      g. Type of test or inspection.
      h. Date of test or inspection.
      i. Results of test or inspection.
      j. Compliance with Contract Documents.

1.06 SPECIAL INSPECTION AGENCY

A. Owner will employ services of a Special Inspection Agency to perform inspections and associated testing and sampling in accordance with ASTM E329 and required by the building code.

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

1.07 QUALITY ASSURANCE

A. Special Inspection Agency Qualifications:
   1. Independent firm specializing in performing testing and inspections of the type specified in this section.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.01 SCHEDULE OF SPECIAL INSPECTIONS, GENERAL

A. Frequency of Special Inspections: Special Inspections are indicated as continuous or periodic.
   1. Continuous Special Inspection: Special Inspection Agency is required to be present in the area where the work is being performed and observe the work at all times the work is in progress.
   2. Periodic Special Inspection: Special Inspection Agency is required to be present in the area where work is being performed and observe the work part-time or intermittently and at the completion of the work.

3.02 SPECIAL INSPECTIONS

A. Special inspections and testing shall be for materials, installation, fabrication, erection or placement of components and connections as indicated on Drawings, but not less than that required by the building code.

END OF SECTION 01 4533

SECTION 01 6000 - PRODUCT REQUIREMENTS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Re-use of existing products.
B. Transportation, handling, storage and protection.
C. Product option requirements.
D. Substitution limitations.
E. Procedures for Owner-supplied products.
F. Maintenance materials, including extra materials, spare parts, tools, and software.

1.02 SUBMITTALS

A. Product Data Submittals: Submit manufacturer's standard published data. Mark each copy to identify applicable products, models, options, and other data. Supplement manufacturers' standard data to provide information specific to this Project.
B. Shop Drawing Submittals: Prepared specifically for this Project; indicate utility and electrical characteristics, utility connection requirements, and location of utility outlets for service for functional equipment and appliances.
C. Sample Submittals: Illustrate functional and aesthetic characteristics of the product, with integral parts and attachment devices. Coordinate sample submittals for interfacing work.
    1. For selection from standard finishes, submit samples of the full range of the manufacturer's standard colors, textures, and patterns.

PART 2 PRODUCTS

2.01 EXISTING PRODUCTS

A. Do not use materials and equipment removed from existing premises unless specifically required or permitted by Contract Documents.
B. Unforeseen historic items encountered remain the property of the Owner; notify Owner promptly upon discovery; protect, remove, handle, and store as directed by Owner.
C. Existing materials and equipment indicated to be removed, but not to be re-used, relocated, reinstalled, delivered to the Owner, or otherwise indicated as to remain the property of the Owner, become the property of the Contractor; remove from site.
D. Specific Products to be Reused: The reuse of certain materials and equipment already existing on the project site is required.
    1. Refer to Drawings and Section 02 4100 - Demolition.

2.02 NEW PRODUCTS

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

2.03 PRODUCT OPTIONS

A. Products Specified by Reference Standards or by Description Only: Use any product meeting those standards or description.
B. Products Specified by Naming One or More Manufacturers: Use a product of one of the manufacturers named and meeting specifications, no options or substitutions allowed.
C. Products Specified by Naming One or More Manufacturers with a Provision for Substitutions: Submit a request for substitution for any manufacturer not named.
D. Available Products: Products specified by naming one or more Manufacturers as an Available Product indicates that these Manufacturers' products may be provided but other comparable products and Manufacturers not named may also be provided without submitting a request for substitution.

2.04 MAINTENANCE MATERIALS

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

B. Deliver and place in location as directed; obtain receipt prior to final payment.

PART 3 EXECUTION

3.01 SUBSTITUTION LIMITATIONS

A. See Section 01 2500 - Substitution Procedures.

3.02 OWNER-SUPPLIED PRODUCTS

A. Owner's Responsibilities:

1. Arrange for and deliver Owner reviewed shop drawings, product data, and samples, to Contractor.
2. Arrange and pay for product delivery to site.
3. On delivery, inspect products jointly with Contractor.
4. Submit claims for transportation damage and replace damaged, defective, or deficient items.
5. Arrange for manufacturers' warranties, inspections, and service.

B. Contractor's Responsibilities:

1. Review Owner reviewed shop drawings, product data, and samples.
2. Receive and unload products at site; inspect for completeness or damage jointly with Owner.
3. Handle, store, install and finish products.
4. Repair or replace items damaged after receipt.

3.03 TRANSPORTATION AND HANDLING

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

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

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

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

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

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

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

3.04 STORAGE AND PROTECTION

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

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

C. Store with seals and labels intact and legible.

D. Store sensitive products in weathertight, climate-controlled enclosures in an environment favorable to product.

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

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

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

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

I. Do not store products directly on the ground.
J. Cover products subject to deterioration with impervious sheet covering. Provide ventilation to prevent condensation and degradation of products.
K. Store loose granular materials on solid flat surfaces in a well-drained area. Prevent mixing with foreign matter.
L. Prevent contact with material that may cause corrosion, discoloration, or staining.
M. Provide equipment and personnel to store products by methods to prevent soiling, disfigurement, or damage.
N. Arrange storage of products to permit access for inspection. Periodically inspect to verify products are undamaged and are maintained in acceptable condition.

END OF SECTION 01 6000

SECTION 01 7000 - EXECUTION AND CLOSEOUT REQUIREMENTS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Examination, preparation, and general installation procedures.
B. Requirements for alterations work, including selective demolition.
C. Pre-installation meetings.
D. Cutting and patching.
E. Surveying for laying out the work.
F. Cleaning and protection.
G. Starting of systems and equipment.
H. Demonstration and instruction of Owner personnel.
I. Closeout procedures, including Contractor's Correction Punch List, except payment procedures.
J. General requirements for maintenance service.

1.02 REFERENCE STANDARDS

A. NFPA 241 - Standard for Safeguarding Construction, Alteration, and Demolition Operations; 2022, with Errata (2021).

1.03 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
B. Cutting and Patching: Submit written request in advance of cutting or alteration that affects:
    1. Structural integrity of any element of Project.
    2. Integrity of weather exposed or moisture resistant element.
    3. Efficiency, maintenance, or safety of any operational element.
    4. Visual qualities of sight exposed elements.
    5. Work of Owner or separate Contractor.
    6. Include in request:
        a. Identification of Project.
        b. Location and description of affected work.
        c. Necessity for cutting or alteration.
        d. Description of proposed work and products to be used.
        e. Effect on work of Owner or separate Contractor.
C. Project Record Documents: Accurately record actual locations of capped and active utilities.
D. Warranties: For each affected material under warranty, submit written verification, signed by manufacturer of existing materials, stating that the Owner's full warranty will remain in effect after cutting and patching operations have been completed

1.04 QUALIFICATIONS

A. For surveying work, employ a land surveyor registered in the State in which the Project is located and acceptable to Architect. Submit evidence of surveyor's Errors and Omissions insurance coverage in the form of an Insurance Certificate. Employ only individual(s) trained and experienced in collecting and recording accurate data relevant to ongoing construction activities,

1.05 PROJECT CONDITIONS

A. Use of explosives is not permitted.
B. Grade site to drain. Maintain excavations free of water. Provide, operate, and maintain pumping equipment.
C. Protect site from puddling or running water. Provide water barriers as required to protect site from soil erosion.
D. Perform dewatering activities, as required, for the duration of the project.

E. Ventilate enclosed areas to assist cure of materials, to dissipate humidity, and to prevent accumulation of dust, fumes, vapors, or gases.
F. Dust Control: Execute work by methods to minimize raising dust from construction operations. Provide positive means to prevent air-borne dust from dispersing into atmosphere and over adjacent property.
   1. Provide dust-proof enclosures to prevent entry of dust generated outdoors.
   2. Provide dust-proof barriers between construction areas and areas continuing to be occupied by Owner.
G. Erosion and Sediment Control: Plan and execute work by methods to control surface drainage from cuts and fills, from borrow and waste disposal areas. Prevent erosion and sedimentation.
   1. Periodically inspect earthwork to detect evidence of erosion and sedimentation; promptly apply corrective measures.
H. Noise Control: Provide methods, means, and facilities to minimize noise produced by construction operations.
   1. Outdoors: Limit conduct of especially noisy exterior work to the hours of 8 am to 5 pm.
   2. Indoors: Limit conduct of especially noisy interior work to the hours of 6 pm to 7 am.
I. Pest and Rodent Control: Provide methods, means, and facilities to prevent pests and insects from damaging the work.
J. Pollution Control: Provide methods, means, and facilities to prevent contamination of soil, water, and atmosphere from discharge of noxious, toxic substances, and pollutants produced by construction operations. Comply with federal, state, and local regulations.

1.06 COORDINATION

A. Coordinate scheduling, submittals, and work of the various sections of the Project Manual to ensure efficient and orderly sequence of installation of interdependent construction elements, with provisions for accommodating items installed later.
B. Notify affected utility companies and comply with their requirements.
C. Verify that utility requirements and characteristics of new operating equipment are compatible with building utilities. Coordinate work of various sections having interdependent responsibilities for installing, connecting to, and placing in service, such equipment.
D. Coordinate space requirements, supports, and installation of mechanical and electrical work that are indicated diagrammatically on drawings. Follow routing indicated for pipes, ducts, and conduit, as closely as practicable; place runs parallel with lines of building. Utilize spaces efficiently to maximize accessibility for other installations, for maintenance, and for repairs.
E. In finished areas except as otherwise indicated, conceal pipes, ducts, and wiring within the construction. Coordinate locations of fixtures and outlets with finish elements.
F. Coordinate completion and clean-up of work of separate sections.
G. After Owner occupancy of premises, coordinate access to site for correction of defective work and work not in accordance with Contract Documents, to minimize disruption of Owner's activities.

1.07 WARRANTIES

A. Existing Warranties: Remove, replace, patch, and repair materials and surfaces cut or damaged during cutting and patching operations, by methods and with materials so as not to void existing warranties.

PART 2 PRODUCTS

2.01 PATCHING MATERIALS

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

B. Type and Quality of Existing Products: Determine by inspecting and testing products where necessary, referring to existing work as a standard.
C. Product Substitution: For any proposed change in materials, submit request for substitution described in Section 01 6000 - Product Requirements.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that existing site conditions and substrate surfaces are acceptable for subsequent work. Start of work means acceptance of existing conditions.
B. Verify that existing substrate is capable of structural support or attachment of new work being applied or attached.
C. Examine and verify specific conditions described in individual specification sections.
D. Take field measurements before confirming product orders or beginning fabrication, to minimize waste due to over-ordering or misfabrication.
E. Verify that utility services are available, of the correct characteristics, and in the correct locations.
F. Prior to Cutting: Examine existing conditions prior to commencing work, including elements subject to damage or movement during cutting and patching. After uncovering existing work, assess conditions affecting performance of work. Beginning of cutting or patching means acceptance of existing conditions.

3.02 PREPARATION

A. Clean substrate surfaces prior to applying next material or substance.
B. Seal cracks or openings of substrate prior to applying next material or substance.
C. Apply manufacturer required or recommended substrate primer, sealer, or conditioner prior to applying any new material or substance in contact or bond.

3.03 PREINSTALLATION MEETINGS

A. When required in individual specification sections, convene a preinstallation meeting at the site prior to commencing work of the section.
B. Require attendance of parties directly affecting, or affected by, work of the specific section.
C. Notify Architect 5 calendar days in advance of meeting date.
D. Prepare agenda and preside at meeting:
    1. Review conditions of examination, preparation and installation procedures.
    2. Review coordination with related work.
E. Record minutes and distribute copies within two days after meeting to participants, with 1 copies to Architect, Owner, participants, and those affected by decisions made.

3.04 LAYING OUT THE WORK

A. Verify locations of survey control points prior to starting work.
B. Promptly notify Architect of any discrepancies discovered.
C. Contractor shall locate and protect survey control and reference points.
D. Protect survey control points prior to starting site work; preserve permanent reference points during construction.
E. Promptly report to Architect the loss or destruction of any reference point or relocation required because of changes in grades or other reasons.
F. Replace dislocated survey control points based on original survey control. Make no changes without prior written notice to Architect.
G. Utilize recognized engineering survey practices.

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

I. Periodically verify layouts by same means.

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

3.05 GENERAL INSTALLATION REQUIREMENTS

A. In addition to compliance with regulatory requirements, conduct construction operations in compliance with NFPA 241, including applicable recommendations in Appendix A.

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

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

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

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

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

3.06 ALTERATIONS

A. Drawings showing existing construction and utilities are based on casual field observation only.
   1. Verify that construction and utility arrangements are as indicated.
   2. Report discrepancies to Architect before disturbing existing installation.
   3. Beginning of alterations work constitutes acceptance of existing conditions.

B. Keep areas in which alterations are being conducted separated from other areas that are still occupied.
   1. Provide, erect, and maintain temporary dustproof partitions.

C. Maintain weatherproof exterior building enclosure except for interruptions required for replacement or modifications; take care to prevent water and humidity damage.
   1. Where openings in exterior enclosure exist, provide construction to make exterior enclosure weatherproof.
   2. Insulate existing ducts or pipes that are exposed to outdoor ambient temperatures by alterations work.

D. Remove existing work as indicated and as required to accomplish new work.
   1. Remove items indicated on drawings.
   2. Relocate items indicated on drawings.
   3. Where new surface finishes are to be applied to existing work, perform removals, patch, and prepare existing surfaces as required to receive new finish; remove existing finish if necessary for successful application of new finish.
   4. Where new surface finishes are not specified or indicated, patch holes and damaged surfaces to match adjacent finished surfaces as closely as possible.

E. Services (Including but not limited to HVAC, Plumbing, Fire Protection, Electrical, and Telecommunications): Remove, relocate, and extend existing systems to accommodate new construction.
   1. Maintain existing active systems that are to remain in operation; maintain access to equipment and operational components; if necessary, modify installation to allow access or provide access panel.

2. Where existing systems or equipment are not active and Contract Documents require reactivation, put back into operational condition; repair supply, distribution, and equipment as required.
3. Where existing active systems serve occupied facilities but are to be replaced with new services, maintain existing systems in service until new systems are complete and ready for service.
   a. Disable existing systems only to make switchovers and connections; minimize duration of outages.
   b. Provide temporary connections as required to maintain existing systems in service.
4. Verify that abandoned services serve only abandoned facilities.
5. Remove abandoned pipe, ducts, conduits, and equipment , including those above accessible ceilings; remove back to source of supply where possible, otherwise cap stub and tag with identification; patch holes left by removal using materials specified for new construction.

F. Protect existing work to remain.
   1. Prevent movement of structure; provide shoring and bracing if necessary.
   2. Perform cutting to accomplish removals neatly and as specified for cutting new work.
   3. Repair adjacent construction and finishes damaged during removal work.

G. Adapt existing work to fit new work: Make as neat and smooth transition as possible.
   1. Where removal of partitions or walls results in adjacent spaces becoming one, rework floors, walls, and ceilings to a smooth plane without breaks, steps, or bulkheads.

H. Patching: Where the existing surface is not indicated to be refinished, patch to match the surface finish that existed prior to cutting. Where the surface is indicated to be refinished, patch so that the substrate is ready for the new finish.

I. Refinish existing surfaces as indicated:
   1. Where rooms or spaces are indicated to be refinished, refinish all visible existing surfaces to remain to the specified condition for each material, with a neat transition to adjacent finishes.
   2. If mechanical or electrical work is exposed accidentally during the work, re-cover and refinish to match.

J. Clean existing systems and equipment.

K. Remove demolition debris and abandoned items from alterations areas and dispose of off-site; do not burn or bury.

L. Do not begin new construction in alterations areas before demolition is complete.

M. Comply with all other applicable requirements of this section.

3.07 CUTTING AND PATCHING

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

B. See Alterations article above for additional requirements.

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

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

E. Employ skilled and experienced installer to perform cutting for weather exposed and moisture resistant elements, and sight exposed surfaces.
F. Cut rigid materials using masonry saw or core drill. Pneumatic tools not allowed without prior approval.
G. Restore work with new products in accordance with requirements of Contract Documents.
H. Fit work air tight to pipes, sleeves, ducts, conduit, and other penetrations through surfaces.
I. At penetrations of fire rated walls, partitions, ceiling, or floor construction, completely seal voids with fire rated material in accordance with Section 07 8400, to full thickness of the penetrated element.
J. Patching:
    1. Finish patched surfaces to match finish that existed prior to patching. On continuous surfaces, refinish to nearest intersection or natural break. For an assembly, refinish entire unit.
        a. This includes painted surfaces.
        b. Where the surface is indicated to be refinished, patch so that the substrate is ready for the new finish.
    2. Match color, texture, and appearance.
    3. Repair patched surfaces that are damaged, lifted, discolored, or showing other imperfections due to patching work. If defects are due to condition of substrate, repair substrate prior to repairing finish.

3.08 PROGRESS CLEANING

A. Maintain areas free of waste materials, debris, and rubbish. Maintain site in a clean and orderly condition.
B. Remove debris and rubbish from pipe chases, plenums, attics, crawl spaces, and other closed or remote spaces, prior to enclosing the space.
C. Broom and vacuum clean interior areas prior to start of surface finishing, and continue cleaning to eliminate dust.
D. Collect and remove waste materials, debris, and trash/rubbish from site periodically and dispose off-site; do not burn or bury.

3.09 PROTECTION OF INSTALLED WORK

A. Protect installed work from damage by construction operations.
B. Provide special protection where specified in individual specification sections.
C. Provide temporary and removable protection for installed products. Control activity in immediate work area to prevent damage.
D. Provide protective coverings at walls, projections, jambs, sills, and soffits of openings.
E. Protect finished floors, stairs, and other surfaces from traffic, dirt, wear, damage, or movement of heavy objects, by protecting with durable sheet materials.
F. Prohibit traffic or storage upon waterproofed or roofed surfaces. If traffic or activity is necessary, obtain recommendations for protection from waterproofing or roofing material manufacturer.
G. Remove protective coverings when no longer needed; reuse or recycle coverings if possible.

3.10 SYSTEM STARTUP

A. Coordinate schedule for start-up of various equipment and systems.
B. Notify Architectand Owner 7 calendar days prior to start-up of each item.
C. Verify that each piece of equipment or system has been checked for proper lubrication, drive rotation, belt tension, control sequence, and for conditions that may cause damage.

D. Verify tests, meter readings, and specified electrical characteristics agree with those required by the equipment or system manufacturer.
E. Verify that wiring and support components for equipment are complete and tested.
F. Execute start-up under supervision of applicable Contractor personnel and manufacturer's representative in accordance with manufacturers' instructions.
G. When specified in individual specification Sections, require manufacturer to provide authorized representative to be present at site to inspect, check, and approve equipment or system installation prior to start-up, and to supervise placing equipment or system in operation.
H. Submit a written report that equipment or system has been properly installed and is functioning correctly.

3.11 DEMONSTRATION AND INSTRUCTION

A. See Section 01 7900 - Demonstration and Training.
B. Demonstrate operation and maintenance of products to Owner's personnel two weeks prior to date of Substantial Completion.
C. Demonstrate start-up, operation, control, adjustment, trouble-shooting, servicing, maintenance, and shutdown of each item of equipment at agreed time, at equipment location.
D. For equipment or systems requiring seasonal operation, perform demonstration for other season within six months.
E. Provide a qualified person who is knowledgeable about the Project to perform demonstration and instruction of Owner's personnel.
F. Utilize operation and maintenance manuals as basis for instruction. Review contents of manual with Owner's personnel in detail to explain all aspects of operation and maintenance.
G. Prepare and insert additional data in operations and maintenance manuals when need for additional data becomes apparent during instruction.

3.12 ADJUSTING

A. Adjust operating products and equipment to ensure smooth and unhindered operation.

3.13 FINAL CLEANING

A. Use cleaning materials that are nonhazardous.
B. Clean interior and exterior glass, surfaces exposed to view; remove temporary labels, stains and foreign substances, polish transparent and glossy surfaces, vacuum carpeted and soft surfaces.
C. Remove all labels that are not permanent. Do not paint or otherwise cover fire test labels or nameplates on mechanical and electrical equipment.
D. Clean equipment and fixtures to a sanitary condition with cleaning materials appropriate to the surface and material being cleaned.
E. Clean filters of operating equipment.
F. Clean debris from roofs, gutters, downspouts, scuppers, overflow drains, area drains, and drainage systems.
G. Clean site; sweep paved areas, rake clean landscaped surfaces.
H. Remove waste, surplus materials, trash/rubbish, and construction facilities from the site; dispose of in legal manner; do not burn or bury.

3.14 CLOSEOUT PROCEDURES

A. Make submittals that are required by governing or other authorities.
B. Accompany Contractor on preliminary inspection to determine items to be listed for completion or correction in the Contractor's Correction Punch List for Contractor's Notice of Substantial Completion.

C. Notify Architect when work is considered ready for Architect's Substantial Completion inspection.
D. Submit written certification containing Contractor's Correction Punch List, that Contract Documents have been reviewed, work has been inspected, and that work is complete in accordance with Contract Documents and ready for Architect's Substantial Completion inspection.
E. Conduct Substantial Completion inspection and create Final Correction Punch List containing Architect's and Contractor's comprehensive list of items identified to be completed or corrected and submit to Architect.
F. Correct items of work listed in Final Correction Punch List and comply with requirements for access to Owner-occupied areas.
G. Notify Architect when work is considered finally complete and ready for Architect's Substantial Completion final inspection.
H. Complete items of work determined by Architect listed in executed Certificate of Substantial Completion.

3.15 MAINTENANCE

A. Provide service and maintenance of components indicated in specification sections.
B. Maintenance Period: As indicated in specification sections or, if not indicated, not less than one year from the Date of Substantial Completion or the length of the specified warranty, whichever is longer.
C. Examine system components at a frequency consistent with reliable operation. Clean, adjust, and lubricate as required.
D. Include systematic examination, adjustment, and lubrication of components. Repair or replace parts whenever required. Use parts produced by the manufacturer of the original component.
E. Maintenance service shall not be assigned or transferred to any agent or subcontractor without prior written consent of the Owner.

END OF SECTION 01 7000

SECTION 01 7800 - CLOSEOUT SUBMITTALS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Project record documents.
B. Operation and maintenance data.
C. Warranties and bonds.

1.02 SUBMITTALS

A. Project Record Documents: Submit documents to Architect with claim for final Application for Payment.
B. Operation and Maintenance Data:
   1. Submit two copies of preliminary draft or proposed formats and outlines of contents before start of Work. Architect will review draft and return one copy with comments.
   2. For equipment, or component parts of equipment put into service during construction and operated by Owner, submit completed documents within ten days after acceptance.
   3. Submit one copy of completed documents 15 days prior to final inspection. This copy will be reviewed and returned after final inspection, with Architect comments. Revise content of all document sets as required prior to final submission.
   4. Submit two sets of revised final documents in final form within 10 days after final inspection.
C. Warranties and Bonds:
   1. For equipment or component parts of equipment put into service during construction with Owner's permission, submit documents within 10 days after acceptance.
   2. Make other submittals within 10 days after Date of Substantial Completion, prior to final Application for Payment.
   3. For items of Work for which acceptance is delayed beyond Date of Substantial Completion, submit within 10 days after acceptance, listing the date of acceptance as the beginning of the warranty period.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.01 PROJECT RECORD DOCUMENTS

A. General:
   1. Project Record Documents include:
      a. Complete set of Record Drawings.
      b. Complete set of Record Submittals.
      c. Complete set of Specifications.
   2. Project Record Documents shall be submitted in electronic form.
      a. File Format: Portable Document Format (PDF).
      b. Files shall be named and organized in a searchable, easy to understand, system.
   3. Ensure entries are complete and accurate, enabling future reference by Owner.
   4. Record information concurrent with construction progress.
B. Record Drawings: Record Drawings shall include the following:
   1. Complete set of Drawings.
      a. Indicate and record actual construction including, but not limited to, the following:
         1) Show all systems and assemblies as they exist at completion of the Work.
         2) Measured horizontal and vertical locations of underground utilities and appurtenances, referenced to permanent surface improvements.
         3) Measured locations of internal utilities and appurtenances concealed in construction, referenced to visible and accessible features of the Work.
         4) Field changes of dimension and detail.
         5) Details not on original Contract drawings.
   2. Addenda.
   3. Change Orders and other modifications to the Contract.

C. Record Submittals: Record Submittals shall include the following:
   1. Complete set of Submittals, including resubmittals.
   2. Shop Drawings shall indicate all field changes and other variations from the Submittal as originally reviewed by Architect.
D. Specifications: Specifications shall include the following:
   1. Complete Project Manual including all specifications, front end material, reports, and information available to bidders, as originally bid.
   2. Addenda.
   3. Change Orders and other modifications to the Contract.

3.02 OPERATION AND MAINTENANCE DATA

A. Source Data: For each product or system, list names, addresses and telephone numbers of Subcontractors and suppliers, including local source of supplies and replacement parts.
B. Product Data: Mark each sheet to clearly identify specific products and component parts, and data applicable to installation. Delete inapplicable information.
C. Drawings: Supplement product data to illustrate relations of component parts of equipment and systems, to show control and flow diagrams. Do not use Project Record Documents as maintenance drawings.
D. Typed Text: As required to supplement product data. Provide logical sequence of instructions for each procedure, incorporating manufacturer's instructions.

3.03 OPERATION AND MAINTENANCE DATA FOR MATERIALS AND FINISHES

A. For Each Product, Applied Material, and Finish:
   1. Product data, with catalog number, size, composition, and color and texture designations.
B. Instructions for Care and Maintenance: Manufacturer's recommendations for cleaning agents and methods, precautions against detrimental cleaning agents and methods, and recommended schedule for cleaning and maintenance.
C. Additional information as specified in individual product specification sections.
D. Where additional instructions are required, beyond the manufacturer's standard printed instructions, have instructions prepared by personnel experienced in the operation and maintenance of the specific products.

3.04 OPERATION AND MAINTENANCE DATA FOR EQUIPMENT AND SYSTEMS

A. For Each Item of Equipment and Each System:
   1. Description of unit or system, and component parts.
   2. Identify function, normal operating characteristics, and limiting conditions.
   3. Include performance curves, with engineering data and tests.
   4. Complete nomenclature and model number of replaceable parts.
B. Where additional instructions are required, beyond the manufacturer's standard printed instructions, have instructions prepared by personnel experienced in the operation and maintenance of the specific products.
C. Panelboard Circuit Directories: Provide electrical service characteristics, controls, and communications; typed.
D. Include color coded wiring diagrams as installed.
E. Operating Procedures: Include start-up, break-in, and routine normal operating instructions and sequences. Include regulation, control, stopping, shut-down, and emergency instructions. Include summer, winter, and any special operating instructions.
F. Maintenance Requirements: Include routine procedures and guide for preventative maintenance and trouble shooting; disassembly, repair, and reassembly instructions; and alignment, adjusting, balancing, and checking instructions.
G. Provide servicing and lubrication schedule, and list of lubricants required.
H. Include manufacturer's printed operation and maintenance instructions.

I. Include sequence of operation by controls manufacturer.
J. Provide original manufacturer's parts list, illustrations, assembly drawings, and diagrams required for maintenance.
K. Provide control diagrams by controls manufacturer as installed.
L. Provide charts of valve tag numbers, with location and function of each valve, keyed to flow and control diagrams.
M. Include test and balancing reports.
N. Additional Requirements: As specified in individual product specification sections.

3.05 ASSEMBLY OF OPERATION AND MAINTENANCE MANUALS

A. General:
   1. Operational and Maintenance Manuals include:
      a. Operational and maintenance data.
      b. Operational and maintenance data for materials and finishes.
      c. Operational and maintenance data for equipment and systems.
   2. Operational and Maintenance Manuals shall be submitted both in electronic form and as hard copy/durable manuals.
      a. Subject to Owner approval, hard copy/durable manuals may be omitted.
      b. Electronic File Format: Portable Document Format (PDF).
         1) Files shall be named and organized in a searchable, easy to understand, system similar to the descriptions for the hard copy/durable manuals
B. Assemble operation and maintenance data into durable manuals for Owner's personnel use, with data arranged in the same sequence as, and identified by, the specification sections.
C. Where systems involve more than one specification section, provide separate tabbed divider for each system.
D. Binders: Commercial quality, 8-1/2 by 11 inch three D side ring binders with durable plastic covers; 3 inch maximum ring size. When multiple binders are used, correlate data into related consistent groupings.
E. Cover: Identify each binder with typed or printed title OPERATION AND MAINTENANCE INSTRUCTIONS; identify title of Project; identify subject matter of contents.
F. Project Directory: Title and address of Project; names, addresses, and telephone numbers of Architect, Consultants, Contractor and subcontractors, with names of responsible parties.
G. Tables of Contents: List every item separated by a divider, using the same identification as on the divider tab; where multiple volumes are required, include all volumes Tables of Contents in each volume, with the current volume clearly identified.
H. Dividers: Provide tabbed dividers for each separate product and system; identify the contents on the divider tab; immediately following the divider tab include a description of product and major component parts of equipment.
I. Text: Manufacturer's printed data, or typewritten data on 20 pound paper.
J. Drawings: Provide with reinforced punched binder tab. Bind in with text; fold larger drawings to size of text pages.
K. Arrangement of Contents: Organize each volume in parts as follows:
   1. Project Directory.
   2. Table of Contents, of all volumes, and of this volume.
   3. Operation and Maintenance Data: Arranged by system, then by product category.
      a. Source data.
      b. Operation and maintenance data.
      c. Field quality control data.
      d. Photocopies of warranties and bonds.

3.06 WARRANTIES AND BONDS

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

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

C. Co-execute submittals when required.

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

E. Manual: Bind in commercial quality 8-1/2 by 11 inch three D side ring binders with durable plastic covers.

F. Cover: Identify each binder with typed or printed title WARRANTIES AND BONDS, with title of Project; name, address and telephone number of Contractor and equipment supplier; and name of responsible company principal.

G. Table of Contents: Neatly typed, in the sequence of the Table of Contents of the Project Manual, with each item identified with the number and title of the specification section in which specified, and the name of product or work item.

H. Separate each warranty or bond with index tab sheets keyed to the Table of Contents listing. Provide full information, using separate typed sheets as necessary. List Subcontractor, supplier, and manufacturer, with name, address, and telephone number of responsible principal.

END OF SECTION 01 7800

SECTION 01 7900 - DEMONSTRATION AND TRAINING

PART 1 GENERAL

1.01 SUMMARY

A. Demonstration of products and systems to be commissioned and where indicated in specific specification sections.

B. Training of Owner personnel in operation and maintenance is required for:
   1. All software-operated systems.
   2. HVAC systems and equipment.
   3. Plumbing equipment.
   4. Electrical systems and equipment.
   5. Items specified in individual product Sections.

C. Training of Owner personnel in care, cleaning, maintenance, and repair is required for:
   1. Roofing, waterproofing, and other weather-exposed or moisture protection products.
   2. Finishes, including flooring, wall finishes, ceiling finishes.
   3. Fixtures and fittings.
   4. Items specified in individual product Sections.

1.02 SUBMITTALS

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

B. Draft Training Plans: Owner will designate personnel to be trained; tailor training to needs and skill-level of attendees.
   1. Submit not less than four weeks prior to start of training.
   2. Revise and resubmit until acceptable.
   3. Provide an overall schedule showing all training sessions.
   4. Include at least the following for each training session:
      a. Identification, date, time, and duration.
      b. Description of products and/or systems to be covered.
      c. Name of firm and person conducting training; include qualifications.
      d. Intended audience, such as job description.
      e. Objectives of training and suggested methods of ensuring adequate training.
      f. Methods to be used, such as classroom lecture, live demonstrations, hands-on, etc.
      g. Media to be used, such a slides, hand-outs, etc.
      h. Training equipment required, such as projector, projection screen, etc., to be provided by Contractor.

C. Training Manuals: Provide training manual for each attendee; allow for minimum of two attendees per training session.
   1. Include applicable portion of O&M manuals.
   2. Include copies of all hand-outs, slides, overheads, video presentations, etc., that are not included in O&M manuals.
   3. Provide one extra copy of each training manual to be included with operation and maintenance data.

1.03 QUALITY ASSURANCE

A. Instructor Qualifications: Familiar with design, operation, maintenance and troubleshooting of the relevant products and systems.
   1. Provide as instructors the most qualified trainer of those contractors and/or installers who actually supplied and installed the systems and equipment.
   2. Where a single person is not familiar with all aspects, provide specialists with necessary qualifications.

B. Coordination: Coordinate demonstration and training of this section with project commissioning requirements.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.01 DEMONSTRATION - GENERAL

A. Demonstrations conducted during system start-up do not qualify as demonstrations for the purposes of this section, unless approved in advance by Owner.

B. Demonstrations conducted during Functional Testing need not be repeated unless Owner personnel training is specified.

C. Demonstration may be combined with Owner personnel training if applicable.

D. Operating Equipment and Systems: Demonstrate operation in all modes, including start-up, shut-down, seasonal changeover, emergency conditions, and troubleshooting, and maintenance procedures, including scheduled and preventive maintenance.

1. Perform demonstrations not less than two weeks prior to Substantial Completion.
2. For equipment or systems requiring seasonal operation, perform demonstration for other season within six months.

E. Non-Operating Products: Demonstrate cleaning, scheduled and preventive maintenance, and repair procedures.

1. Perform demonstrations not less than two weeks prior to Substantial Completion.

3.02 TRAINING - GENERAL

A. Conduct training on-site unless otherwise indicated.

B. Do not start training until Functional Testing is complete, unless otherwise specified or approved by the Commissioning Authority.

C. Provide training in minimum two hour segments.

D. Training schedule will be subject to availability of Owner's personnel to be trained; re-schedule training sessions as required by Owner; once schedule has been approved by Owner failure to conduct sessions according to schedule will be cause for Owner to charge Contractor for personnel "show-up" time.

E. Review of Facility Policy on Operation and Maintenance Data: During training discuss:

1. The location of the O&M manuals and procedures for use and preservation; backup copies.
2. Typical contents and organization of all manuals, including explanatory information, system narratives, and product specific information.
3. Typical uses of the O&M manuals.

F. Product- and System-Specific Training:

1. Review the applicable O&M manuals.
2. For systems, provide an overview of system operation, design parameters and constraints, and operational strategies.
3. Review instructions for proper operation in all modes, including start-up, shut-down, seasonal changeover and emergency procedures, and for maintenance, including preventative maintenance.
4. Provide hands-on training on all operational modes possible and preventive maintenance.
5. Emphasize safe and proper operating requirements; discuss relevant health and safety issues and emergency procedures.
6. Discuss common troubleshooting problems and solutions.
7. Discuss any peculiarities of equipment installation or operation.
8. Discuss warranties and guarantees, including procedures necessary to avoid voiding coverage.
9. Review recommended tools and spare parts inventory suggestions of manufacturers.
10. Review spare parts and tools required to be furnished by Contractor.
11. Review spare parts suppliers and sources and procurement procedures.

G. Be prepared to answer questions raised by training attendees; if unable to answer during training session, provide written response within three days.

END OF SECTION 01 7900

SECTION 28 1000 – TECHNOLOGY OVERVIEW

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. This section provides a project overview and general project and Contractor requirements for technology work.

B. The “Contractor” as referred to in these specifications, shall be the bidder whose bid is eventually chosen as the winner.

C. The “Engineer” as referred to in these specifications, shall be Commtech Design and its representative on this project.

D. The “Owner” as referred to in these specifications, shall be Dexter Community Schools and its representatives.

E. In the detailed specifications and on the contract drawings, the phrases “or equivalent,” “approved equivalent,” “approved equal,” “or equal” and “engineer approved equivalent” shall be used interchangeably and shall mean the same thing.

F. All equals, equivalents, or alternates shall be approved by the Engineer prior to ordering or installation. Without approval, deviation from the products listed in the specifications and on the drawings, shall be presumed to be nonconforming and shall be removed and replaced at the direction of the Engineer and at the Contractor’s expense.

1.02 DESCRIPTION OF PROJECT

A. Bid Category #1 Cabling and communications infrastructure.

1. The communications portion of the project encompasses communications cabling and termination equipment. The work shall include but not be limited to:
    a. Communications room racks and cabinets.
    b. Communications Cabling and Termination Equipment:
    a. User UTP Plenum rated CAT-6 and CAT-6A cabling
    b. Fiber optic cabling and termination.
        1) Terminate and test each fiber strand. Terminate into panels at each end.
2. All cables shall be labeled according to the drawings and the specifications.
3. All cables shall be terminated and tested as per the specifications.
4. Contractor shall provide personnel and equipment for full training and commissioning of the system.
2. All cables shall be supported by J-hooks or cable tray/ladder.
3. Label all cables
4. Test all cables.
5. The extent of the work shall be as shown on the drawing and detailed in these specifications

B. Bid Category #2 Audio and Video Systems

1. The audio and video systems in the building shall consist of but not be limited to:
    a. Classroom AV Systems
    b. Conference room AV systems
    c. Large room AV systems
2. Test all AV systems
3. The extent of the work shall be as shown on the drawing and detailed in these specifications
4. Paging Systems
    a. Provide and install new Paging system equipment at the locations noted.
    b. The owner uses Informacast by Singlewire and that shall be the basis for expanded paging in all new and renovated spaces
    c. Paging system shall be a combined Paging and Bell system that shall support the entire building or buildings as noted
    d. Work shall include but not be limited to:
        1) Paging headend and expansion of Informacast software.
        2) Interfaces of the paging system to other systems noted
        3) New paging speakers
        4) Cabling for connectivity of:

a) Data network
b) Security system

5) System Configuration, Bell schedules and system training

e. All cables shall be terminated and tested as per the specifications.
1) All cables shall be supported by J-hooks in the ceiling.
2) Label all cables
3) Test all cables.

f. Contractor shall provide personnel and equipment for full training and commissioning of the system.

g. The extent of the work shall be as shown on the drawing and detailed in these specifications.

C. Bid Category #3 Access Control System
1. Install an access control system in the building(s).
a. Provide and install all equipment and servers and software required.
2. Install all cabling required connect each door to the security panels
a. Security panels shall be located in each communications room. See drawings.
b. Wire from each power supply to the panels and to the devices at the doors
3. Install intercoms. Where the intercom is connected to the data network the contractor shall provide all patch cables and configure the network to support the intercoms
4. Configure the system as per the owner's requirements. Meet with them to determine configuration parameters
5. The extent of the work shall be as shown on the drawing and detailed in these specifications

D. Bid Category #4 Video Security System
1. See drawings and specs for CAT-6 cable installation and who is responsible for installing cabling.
2. Provide and install all cameras at all locations noted
3. Provide and install servers and software for monitoring and recording all new security cameras plus any spare processing and space as detailed in the Security Recording specification.
4. Fully configure all software and hardware required for recording of camera images
5. Install viewing software on owner's computers and devices.
6. The extent of the work shall be as shown on the drawing and detailed in these specifications

E. Post installation documentation
1. Each contractor shall provide post installation documentation as per the specifications. Shall include but not be limited to:
a. Red-lined as-built drawings
b. As-built detailed connectivity and floorplan locations of Cabling, AV, Access Control, and Video Security Systems.
c. As-built cable locations and cable labels at each location.
d. Mark all splice locations for any cabling.
e. Update of all access control locations and equipment at each door
f. Camera locations and camera numbers.
g. Spreadsheet (hard copy and Excel file) for all network, Wireless, telephones and cameras detailing:
1) Mfg. Part number
2) IP Address
3) MAC Address
4) Device number (Camera #, Telephone # etc)

1.03 DOCUMENTS

DWG.	Drawing Name	Bid Category #1 Cabling	Bid Category #2 AV Systems	Bid Category #3 Acc Ctrl	Bid Category #4 Video Security
	HIGH SCHOOL ADDITION AND RENOVATION				
TC101	Cabling Legends, Schedules & Details				
TC102	Cabling Connectivity Codes				
TC103	Cabling Routing Details & Fiber Backbone				
TC201C	First Floor Zone C Cabling Plan				
TC201F	First Floor Zone F Cabling Plan				
TC202A	Second Floor Zone A Cabling Plan				
TC301	Audio/Video Legends, Schedules & Details				
TC302	Audio/Video Connectivity Details				
TC303	Audio/Video Connectivity Details				
TC304	Audio/Video Connectivity Details				
TC401F	First Floor Zone F A/V Plan				
TC402A	Second Floor Zone A A/V Plan				
TC501	Security Legends, Schedules & Details				
TC502	Security Equipment Details				
TC503	Camera Mounting Details				
TC504	Camera One-Line Details				
TC601C	First Floor Zone C Security Plan				
TC601F	First Floor Zone F Security Plan				
TC602A	Second Floor Zone A Security Plan				
TR101	Raceway Legends, Schedules & Details				
TR102	Raceway Connectivity Codes				
TR201C	First Floor Zone C Raceway Plan				
TR201F	First Floor Zone F Raceway Plan				
TR202A	Second Floor Zone A Raceway Plan				
	HIGH SCHOOL FIELDHOUSE				
TC101	Cabling Legends, Schedules & Details				
TC102	Cabling Connectivity Codes				
TC103	Cabling Routing Details & Fiber Backbone				
TC201A	First Floor Cabling Zone A				
TC201B	First Floor Cabling Zone B				
TC202A	Second Floor Cabling Zone A				
TC301	Audio/Video Legends, Schedules & Details				
TC302	Audio/Video Connectivity Details				
TC303	Audio/Video Connectivity Details				
TC401A	First Floor Audio/Video Zone A				
TC402A	Second Floor Audio/Video Zone A				
TC402B	Second Floor Audio/Video Zone B				
TC501	Security Legends, Schedules & Details				
TC502	Security Equipment Details				

DWG.	Drawing Name	Bid Category #1 Cabling	Bid Category #2 AV Systems	Bid Category #3 Acc Ctrl	Bid Category #4 Video Security
TC503	Access Control Diagram				
TC504	Camera Mounting Details				
TC505	Camera One-Line				
TC601A	First Floor Security Zone A				
TC601B	First Floor Security Zone B				
TR101	Raceway Legends, Schedules & Details				
TR102	New Door Access Control				
TR201A	First Floor Raceway Zone A				
TR201B	First Floor Raceway Zone B				
TR202A	Second Floor Raceway Zone A				
TR202B	Second Floor Raceway Zone B				
	WYLIE CLASSROOM ADDITION				
TC101	Technology Legends, Schedules & Details				
TC102	Cabling Connectivity Codes				
TC103	Cabling Rack Layouts & Details				
TC201	First Floor Cabling Plan Unit F				
TC301	AV Legends, Schedules & Details				
TC401	First Floor AV Plan Unit F				
TC501	Security Legends, Schedules & Details				
TC502	Security Details				
TC503	Door Hardware Security Details				
TC601	First Floor Security Plan Unit F				
TR101	Raceway Legends, Schedules & Details				
TR201	First Floor Raceway Plan Unit F				

Specification		Bid Category #1 Cabling	Bid Category #2 AV Systems	Bid Category #3 Acc Ctrl	Bid Category #4 Video Security
28 1000	Technology Overview	X	X	X	X
28 1100	Communications Room	X			
28 1150	Communications Grounding	X	X	X	X
28 1500	Fiber Cabling	X			
28 1600	Cat-6/6A Cabling	X			
28 1700	Clock System-IP		X		
28 1800	Paging-IP System		X		
28 3500	Access Control			X	
28 3600	Security Recording				X
28 3700	Security Cameras				X
28 5000	AV Systems Integration		X		
28 5350	Classroom Audio		X		
28 5400	Video Equipment		X		
28 5401	Flat Panel Video Displays		X		
28 5450	Audio Equipment		X		

28 5453	Audio Speakers		X		
28 5470	AV Cabling		X		
28 7200	Technology Submittals	X	X	X	X
28 7600	Technology Labeling	X	X	X	X
28 7700	Technology Testing	X	X	X	X
28 7750	Technology Training	X	X	X	X
28 7800	Technology Warranty	X	X	X	X

1.04 STORAGE OF MATERIALS

A. All materials shall be secured when not in use by the Contractor.

B. It shall be the Contractor's responsibility to secure all equipment including all material to be installed as part of the contract. No changes shall be made to the contract due to loss or theft of equipment and materials not officially accepted by the Owner.

1.05 PERMITS

A. The State of Michigan requires that the Contractor apply for and obtain permits for data telecommunication installation.

B. This is required under State of Michigan Public Act 230. The inspector at the State of Michigan states that the code never exempted data telecommunications from permits and previous rules had overstepped their bounds. Only exemptions to the permit requirements are found in Public Act 230 MCL125.1528a.

1. There is not a license required to apply for a permit per Public Act 407 MCL339.5737(3)(o).

C. The Permit is required under Public Act 230. The permit is under 2017 Michigan Electrical Code rules Part 8.

D. People who can obtain the permit include the Owner of the building or a company representing the owner. See Public Act 230 MCL125.1510.

1. Contractor shall be required to apply for and obtain the permit
2. Contractor shall be required to install the data telecommunications system to fully meet all code requirements and requirements of the Inspector and Authority Having Jurisdiction (AHJ)

E. State inspector has noted that the inspection process for data telecommunications is the same as any other inspection.

1. Do not cover or conceal any wiring without approval.
2. Electrical Inspectors will be conducting the inspections.
3. Contractor shall be responsible for scheduling the inspections and attending the inspections with the inspector

F. State inspector has noted that the inspectors will be inspecting for code compliance including manufacture's installation instructions for the cables and terminations.

G. An installation may not pass inspection if there is any Non-compliance with the code.

1.06 REFERENCE SPECIFICATIONS-CABLING

A. All work applicable shall conform to the following standards:

B. ANSI/TIA-568-C.0, "*Generic Telecommunications* Cabling *for Customer Premises*",

C. ANSI/TIA-568-C.1, "*Commercial Building Telecommunications Cabling Standard*",

D. ANSI/TIA-568-C.2, "*Balanced Twisted-Pair Telecommunication Cabling and Components Standard*", ANSI/TIA-568-C.3, "*Optical Fiber Cabling Components Standard*",

E. ANSI/TIA-568-C.4, "*Broadband Coaxial Cabling and Components Standard*",

F. ANSI/TIA/EIA-569-B Commercial Building Standard for Telecommunications Pathways and Spaces

G. IA-606-B: Administration Standard for the Telecommunications Infrastructure of Commercial Buildings including all Updates and Addenda.

H. TIA-607-C: Generic Telecommunications Bonding and Grounding (Earthing) for Customer Premises.

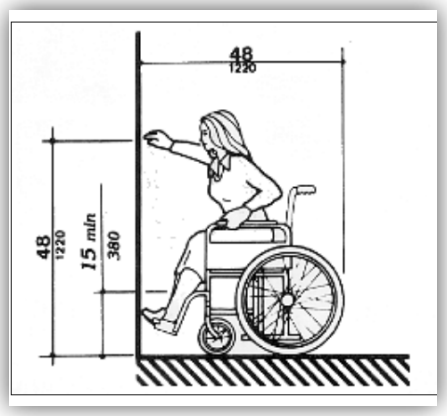
I. EIA-472 General Specification for Fiber Optic Cable

J. EIA-472A Sectional Specification for Fiber Optic Communication Cables for Outside Aerial

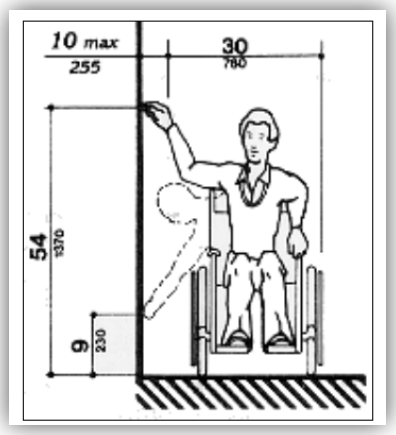
K. EIA-472B Sectional Specification for Fiber Optic Communication Cables for Underground and Buried Use
L. EIA-472C Sectional Specification for Fiber Optic Communication Cables for Indoor Use
M. EIA-472D Sectional Specification for Fiber Optic Communication Cables for Outside Telephone Plant Use
N. NEC, 2015, or latest edition available
O. IEEE 802.3af PoE • Ratified in 2003 • 15.4W at the PSE, with min of 12.95W available to the PD
P. IEEE 802.3at PoE+ • Ratified in 2009 • 34.2W at the PSE, with min of 25.5W available to the PD
Q. IEEE 802.3bt-2018 - IEEE Standard for Ethernet Amendment 2: Physical Layer and Management Parameters for Power over Ethernet over 4 pairs

1.07 ADA REQUIREMENTS

A. All equipment that is to be interacted with shall be installed to meet ADA requirements.
   1. This includes all buttons, card readers and other devices that need to be pushed or flipped or interacted with.
B. High Forward Reach Limit. Facing a wall, surface or element -- maximum reach height is 48 inches (1220 mm) and minimum low forward reach height is 15 inches (380 mm). Clear floor space 48 inches (1220 mm) deep and 30 inches (760 mm) wide.



C.
D. High and Low Side Reach Limits. For a parallel approach the maximum high side reach is 54 inches (1370 mm) and the minimum low side reach is 9 inches (230 mm). The clear floor space is no more than 10 inches (255 mm) from the wall, surface or element.
   1. If the clear floor space allows parallel approach by a person in a wheelchair, the maximum high side reach allowed shall be 54 in (1370 mm) and the low side reach shall be no less than 9 in (230 mm) above the floor



1.08 SUPPORT OF DEVICES AND CABLING

A. All installations shall meet the requirements of NFPA 70 NEC 2026 Section 300.xx

B. Independent cabling Support:

1. Wiring and equipment must be supported by independent support wires or fittings attached to the building structure, not the ceiling grid.
2. Identification: Independent support wires must be distinguishable from the ceiling grid wires (e.g., colored or tagged).
3. Securing: The cables and support mechanisms must be secured at both ends.
4. This means that if there are separate wires installed to support cables in a ceiling they must be painted a color (yellow) and attached to the building structure and t-bar of the drop ceiling structure.

C. Device Support shall meet NEC 314.23(d) Mounting to Suspended Ceilings:

1. Enclosures (for speakers or cameras) mounted on ceiling tiles cannot exceed 100 in³ (1650 cm³) and must be fastened to framing members by mechanical means (screws, clips, or bolts)
2. Securement: They must be securely fastened to the ceiling grid using screws, bolts, rivets, or listed clips (often called "earthquake clips").
3. Weight: If the fixture is too heavy for the grid to support without sagging, it must be supported directly from the building structure.
4. Examples of “Listed” T-bar Devices are:
5. nVent CADDY #512HD or Eaton B-Line BA50A





6.
7. Where the device being supported weighs more than 10 lbs then there shall be a separate support of the t-bar or device directly to the building structure.

1.09 CONTRACTOR-ALL

A. Each contractor shall be responsible for inspecting their own work and ensuring it meets the project requirements.

B. Contractor shall have a project manager who will be responsible for all work, workers, equipment, cabling and project management for their work. The project manager shall have the authority to make decisions for the contractor and schedule all workers.
C. Contractor shall attend all project meetings throughout the project.
D. All work on the project shall meet all applicable state, federal, local and industry codes and be installed according to the requirements of he Authority Having Jurisdiction (AHJ).
E. Contractor shall provide all equipment, man-lifts, ladders, transportation etc, required to install all specified cabling and equipment.

1.10 CONTRACTOR -CABLING

A. The Contractor shall have a BICSI certified Registered Communications Distribution Designer (RCDD) identified that will be responsible for all aspects of the installation. (This person does not have to be a direct employee of the bidder but must inspect the work to ensure that it is done based on standards)
   1. The resume of the RCDD, and a list of past projects the RCDD has worked on, shall be submitted with the submittal package. The Engineer reserves the right to reject the RCDD, and require the Contractor to assign another if the RCDD is found not to have sufficient experience in projects of relatively the same scope.
   2. If during the course of the work, the Contractor changes the RCDD assigned to the project, the Contractor shall provide the resume of the new RCDD and a list of projects of similar scope the new RCDD has worked on.
B. The Contractor shall show proof of an existing contractual relationship with the approved equipment manufacturer of the horizontal cabling system, and shall pass through the manufacturer's certification and warranty to purchaser.
C. All faceplates and termination hardware shall be sourced from the certifying manufacturer to assure quality control and validity of the manufacturer's warranty.
D. The Contractor shall accept complete responsibility for the installation, certification, and support of the cabling system. Contractor must show proof that he has the certifying manufacturer's support on all of these issues.
E. All work shall be performed and supervised by Telecommunications Technicians and Project Managers who are qualified to install voice, data, and image cabling systems, and to perform related tests as required by the manufacturer in accordance with the manufacturer's methods.
F. The Telecommunications Technicians employed shall be fully trained and qualified by the manufacturer on the installation and testing of the equipment to be installed. Evidence that the vendor is a current Certified Installer of the manufacturer must be provided in writing prior to work commencing on the structured cabling for the building.
G. The Contractor (including Subcontractor(s) if any) shall have a proven track record in cabling projects. This must be shown by the inclusion of details of at least 3 projects involving Category 6 or better cabling and optical fiber, which have been completed by the vendor in the last 2 years. Names, addresses, and phone numbers of references for the 3 projects shall be included.

1.11 CONTRACTOR –AUDIO/VIDEO

A. The Contractor shall accept complete responsibility for the installation, certification, and support of the system. Contractor shall show proof that they have the certifying manufacturer's support on all of these issues.
B. All work shall be performed and supervised by Audio/Video Technicians and Project Managers who are qualified to install audio/video systems and cabling and to perform related tests as required by the manufacturer in accordance with the manufacturer's methods.
C. The Audio/Video Technicians employed shall be fully trained and qualified by the manufacturer on the installation and testing of the equipment to be installed.
D. The vendor (including Subcontractor(s) if any) shall have a proven track record in audio/video system configuration and installation. This must be shown by the inclusion of details of at least 3 projects involving the installation of like sized audio/video systems that have been completed by the vendor in the last 2 years. Names, addresses, and phone numbers of references for the three projects shall be included.

1.12 CONTRACTOR –ACCESS CONTROL AND VIDEO SECURITY

A. The Contractor shall show proof of an existing contractual relationship with the approved equipment manufacturer of the video security system and access control system and shall pass through the manufacturer's certification to purchaser.

B. All hardware shall be sourced from the certifying manufacturer to assure quality control and validity of the manufacturer's warranty.

C. The Contractor shall accept complete responsibility for the installation, certification, and support of the security system. Contractor must show proof that he has the certifying manufacturer's support on all of these issues.

D. All work shall be performed and supervised by security technicians and project managers who are qualified to install security systems, and to perform related tests as required by the manufacturer in accordance with the manufacturer's methods.

E. The security technicians employed shall be fully trained and qualified by the manufacturer on the installation and testing of the equipment to be installed. Evidence that the vendor is a current certified installer of the manufacturer must be provided in writing prior to work commencing on the video security system.

F. The Contractor (including Subcontractor(s) if any) shall have a proven track record in security projects. This must be shown by the inclusion of details of at least 3 projects similar in scope and requirements which have been completed by the vendor in the last 2 years. Names, addresses, and phone numbers of references for the 3 projects shall be included.

PART 2 - PRODUCTS

2.01 FIRESTOPPING

A. Each contractor shall be responsible for firestopping around their cables and the raceways.

B. Shall be completed inside and around all conduits after cable installation.

C. Firestop for the area between the cable and the edge of the conduit shall be Nelson No. FSP, CLK or LBS+. Contractor shall install the best firestop for each individual installation.
   1. Firestop shall be installed with regard to local and national building codes.
   2. The firestop shall be a putty like substance that expands under heat and will not allow flame to pass for a designated period of time.
   3. Firestop shall conform to all NEC, NFPA, and UL requirements.
   4. Some wall pass-thru’ s are shown on the drawings. The Contractor shall utilize these where possible.
   5. Where the contractor must install cables through a wall where there is no pass-thru already provided, the Contractor shall be responsible for installing a fire-rated pass-thru and fire-stopping the conduit after cable installation.

D. Firestopping is required at all riser conduits and all pass thru’s.
   1. Each cable tray penetration of a wall shall be firestopped after cable installation. Use pillow type firestop to allow additional cables to be installed in the future.
   2. Where riser conduits pass through floors, the area between the concrete and the conduit shall be firestopped. This shall be completed with a putty or liquid firestop product. Fill in the space with mineral wool, and then install the firestop on top. All firestop shall be of sufficient thickness to secure the rating required by code.
   3. After final cable installation, install a putty firestop around all cables where they enter and exit conduit pass thru’s and conduit risers.
   4. All firestop shall be installed to provide the fire rating as described by local fire code.
   5. It shall be the responsibility of the Contractor to verify that all conduits, walls, and raceways required to be firestopped have been firestopped.

E. Contractor shall provide a label at each penetration and firestop location detailing the UL rated fireproofing solution that was used in the specific application.
   1. Apply sticker to the wall near the firestopped conduit.
   2. Provide a sample of the label to the designer for review as part of the submittals.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Contractor shall be familiar with the location(s) where the work will be done. No additional compensation will be made for items the Contractor claims he was not aware of during bidding.

B. Work Area:
   1. All work areas shall be cleaned at the end of each day. All debris shall be cleaned and removed from the site and disposed of in the approved container for the site.
   2. All equipment shall be moved out of common areas and stored in the Contractor's lay down area, or in other approved storage locations on site.
   3. Any work that is low hanging, or may otherwise impede the general use of the space, and cannot be removed, shall be flagged and cordoned off by the Contractor.

C. All equipment and parts shall be installed in a neat and workmanlike manner. Good installation principles shall be used throughout the project.

D. All cables routed above the drop ceiling or in the ceiling area shall be installed square to the building. Diagonal cable runs are not permissible.

E. All cut edges of conduits, boxes, raceway, etc., shall be trimmed and filed so that no burrs or rough edges will damage cable as it is installed.

F. All surface raceways, including conduits in exposed areas shall be painted to match the existing colors of the surrounding area.

G. If, in the course of the work, the Contractor damages, marks, or misplaces any ceiling tiles, the Contractor shall repair, and/or replace the ceiling tile to the original condition.
   1. The Engineer shall decide if ceiling tiles have been damaged. Based on the Contractors proposed fixes, the Engineer shall decide the best course of action to repair any damage done by the Contractor to the ceiling tiles.

H. It shall be the responsibility of the Contractor to repair any damage done to the structure or finishes in the building by the Contractor. The building shall be returned to its original condition prior to final sign off of the project.

I. Firestop shall be installed to meet national and local codes.

3.02 DOCUMENTS

A. The Contractor shall fully read the contract documents including the detailed specifications, and the detailed drawings.

B. No additional compensation shall be made for any portion of the project which the Contractor did not know of or understand prior to providing the bid response.

C. In the case of any discrepancies between the detailed drawings and the detailed specifications, the Contractor shall provide the higher quality or more stringent requirement.

3.03 WORK PLAN-POST BID (CHOSEN CONTRACTOR ONLY)

A. Along with the submittals the Contractor shall provide a work plan for the implementation of the system they are installing. The plan shall include scheduled dates for major milestones, and all phases required for completion prior to final cutover.

B. The work plan shall list all items that must be completed by the Contractor or Owner to provide a smooth install of the system. The Contractor shall be responsible for all costs associated with the planning and cutover. The Owners only responsibility is to act as a liaison between the Contractor and the users.

C. The work plans shall include a time-line and a cutover date for the systems within each building. Contractor shall be responsible for all aspects of scheduling the work, including notification of the users, the administration, and the telephone service provider.

D. The work shall commence within 10 days of award of the contract. The Contractor shall be responsible for attending weekly project meetings at the Owner's site to report on progress and keep the project team informed of the work being done

E. The work plan will be reviewed at each project meeting for compliance and updates.

F. Work shall immediately begin on site surveys to determine the existing infrastructure, conduit and raceway placement and determining placement of new system equipment. The Contractor shall be responsible for moving, relocating, and reconnecting any and all existing equipment required for the installation of the new systems.

G. After work plan and system approval by the Engineer the Contractor can begin work on infrastructure work that does not impede users.
H. The Contractor shall be responsible for working with the Owner's Information Technology staff and administrators.

END OF SECTION 28 1000

SECTION 28 1100 – COMMUNICATIONS ROOM

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Parts and equipment required for equipment in the communications room (Comm Room)

1.02 SYSTEM DESCRIPTION

A. All equipment in the communications room shall be installed so that access is provided to all components, mechanical and electrical.

B. All components of the communications room shall work together to form a cohesive and complete communications infrastructure.

1.03 COORDINATION

A. Coordinate rack/cabinet work with the Electrical Contractor for placement of electrical connections.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Approved Equals for Racks and Cable Ladder Hardware:
   1. Hubbell.
   2. Ortronics
   3. Panduit.
   4. Great Lakes Case and Cabinet.
   5. Middle Atlantic.
   6. Hoffman

2.02 CABINETS -WALL MOUNTED

A. Wall Mount Cabinet:
   1. The wall mount cabinets shall be black in color.
   2. Cabinets shall provide adjustable 19-inch rack mounting rails.
   3. Each cabinet shall have a center swingout feature that allows access to the front and back of equipment after it is installed in the cabinet.
   4. Knockouts for different size conduits shall be provided on the top and bottom of the cabinet.
   5. Swing side of the cabinet shall be reversible.
   6. Each cabinet shall be no less than 23.5 inches deep.
   7. 48” tall cabinet shall be Hoffman # EWMWG482425
   8. Each cabinet shall be provided with the following hardware:
      a. Plexiglas front door with lock.
      b. Fan assembly mounted in the top of the cabinet. Hoffman #EWMF2
      c. 6 position power strip with circuit breaker and surge suppressor.
         1) Hubbell #PH20A10S or equal.

2.03 COMMUNICATIONS RACKS

A. Two Post Communications rack, 19 inches wide, 84 inches high. Black in color with 45 rack mounting units (1.75 inches per RU), self-supporting.
   1. Rack shall have holes to attach 6 inch wide vertical organizers.
   2. Base shall have holes for attaching to the floor.
   3. The rack shall be Hubbell #HWP84RR19 or approved equal.
   4. Equip with 6” wide vertical organizers between each rack
   5. Equip with two (2), vertical Organizers for installation between and on each side of a rack.

B. Four-post adjustable rack with front and back mounting rails.
   1. Rack shall be adjustable for depths between 21 inches and 32 inches. Adjustment shall be in increments of 1/2 inch.
   2. Rack shall have universal mounting holes on the front and back rack rails
   3. Rack shall be black in color.
   4. Rack shall be Ortronics # 19-84-T4SDA2132 or equal. Tapped holes

5. Equip with two (2), vertical Organizers for installation between and on each side of a rack.

C. Vertical organizers for racks
1. Provide and install vertical organizers for new and existing racks as shown on the drawings
2. Shall be front and back organizer. Front shall have a cover. Rear shall have cabler containment gates
3. Shall be 7’ tall. 6” wide and single sided. No back organizing is required.
4. Vertical organizer shall be able to be mounted to side of existing racks. Custom fit this. If rack is smaller than 7/ then cleanly cut the organizer to fit.
5. Move cables and route the cables into the organizer to neatly route cables. Remove all items from the side of existing racks and install into the organizer.
   a. 6” wide Vertical organizer shall be
      1) RXL #3326-BK06 or
      2) Hubbell #VME67
6. Where there is not 6” of space available, the vertical organizer shall be 4” wide, RXL # 3326-BK04. Confirm onsite at each rack prior to ordering.

2.04 POWER STRIPS

A. 20 AMP vertical power strip
1. Single circuit 120 Volt, 20 AMP
2. Receptacles shall be NEMA 5-15/20R Quantity of 14.
3. Plug shall be NEMA l5-20P with 15’ minimum cord. Include Adapter for 5-20P outlet
4. Circuit breaker with on/off switch
5. Two digit power meter showing total AMP usage
6. Raceway and all components shall be UL listed. The base and cover shall be black in color and shall be attached to the cable ladder of the rack system.
7. Provide all attachment hardware required to securely attach the outlet strip to the back of the vertical cable ladder or side of rack. Refer to detailed drawings for location.
8. Coordinate with electrician to verify plug and outlet in the wall connectivity.
9. Install and test all outlets prior to project completion.
10. Shall be Eaton #PDUMV20-36 equal

2.05 CABLE LADDER

A. Equip communication racks with cable ladder system for cable support and routing. Refer to Figure 28 110-A below.
1. All cable ladders shall be custom cut to fit.
2. Install cable ladder vertically behind each vertical organizer.
3. Center the cable ladder on the vertical organizer so that when additional racks are added, the cable ladder can be used to serve both racks, and will not interfere with the components mounted in the rack.

B. Cable Ladder - Black and cut to length.
1. 12” wide, 10’ long cable ladder with channels. Hubbell #hsls1012B or equal.
2. Equip with the following as required for a full installation as per the details and specifications:
   a. Relay Rack Mounting Kit, Hubbell #HLMPK19 or equal
   b. Wall support angle bracket, Hubbell #HLTSB12B or equal
   c. Corner clamp for connecting horizontal ladder on the top to the cable ladder that attaches to the wall. Hubbell #HLTK or equal.
   d. Wall saddle for attaching horizontal cable ladder section to the wall. Equipped with “J” bolts. Hubbell #HLX0612 or equal
   e. Cable Radius Drop for dropping cables down to vertical cable ladder between and to the side of each rack, Hubbell #HLCD12 or equal
   f. Foot Kit for Cable ladder at back of rack, Hubbell #HLRF or equal
   g. Butt Splice Kit, Hubbell #HSBSK or equal
   h. Swivel Splice kit, Hubbell #HLSSK or equal

i. When mounting cable ladder along the wall, install supports to the wall, Hubbell #HLVWBK or equal
j. Attach all cable ladders to the rack with unistrut and unistruts “L” and “T” connectors.
k. Approved equals, Newton and Hubbell.

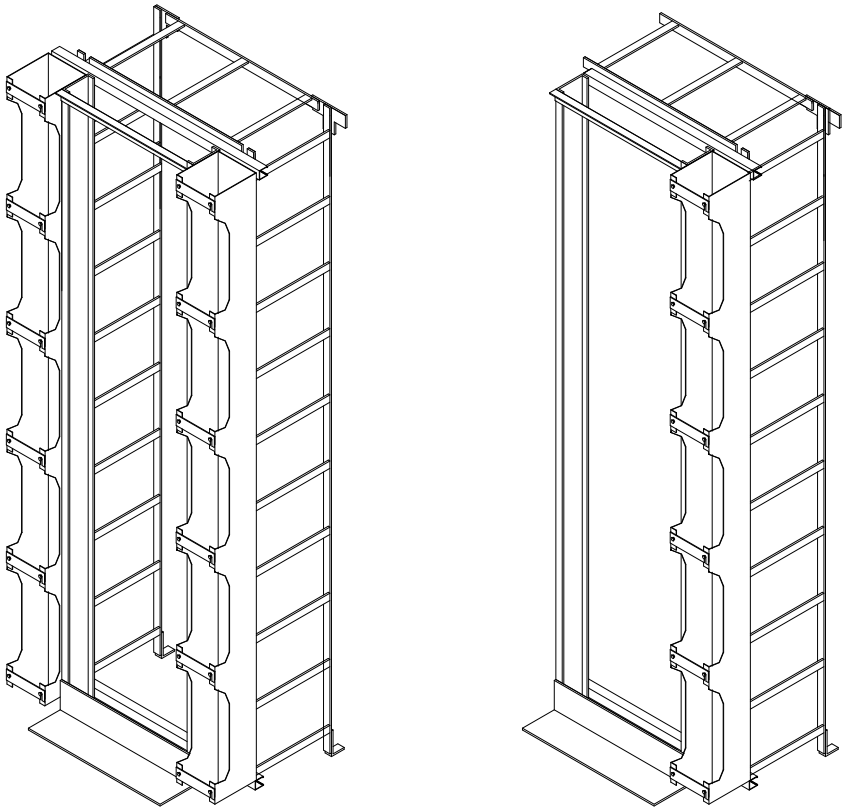


Figure 28 1100-A – Isometric View of Communications Racks

2.06 COMMUNICATIONS ROOM EQUIPMENT

A. Patch Cord Organizers:
1. Patch cords organizers shall be steel and shall allow routing of patch cables from electronics to the patch panels.
2. Single rack unit organizer shall be Hubbell #HS13C with cover. Refer to PCO-1 on detailed drawings.
3. Approved equals, Ortronics and Great Lakes Case and Cabinet.

B. Tie Wraps:
1. Tie wraps shall be used on exterior cables only.
2. Tie wraps should not be used above the drop ceiling or in cable tray. The pathway shall support the cables without the use of extra tie wraps.
3. Tie wraps shall never be used to support cables from building structure, electrical conduits, or lighting systems.
4. Panduit No. PLT2S-C or equal standard tie wrap. For use in general locations that are not plenum rated.
5. Panduit No. PLT2S-C702 or equal plenum rated tie wrap. Use only this type of tie wrap in plenum rated areas.
6. Panduit No. PLT2H-L00 or equal ultraviolet rated outside plant tie wrap. Use only this type of tie wrap for outside uses.

C. Hook and Loop Wraps:

1. Hook and Loop wraps shall be used on the cable ladder of the rack systems to bundle the cables as they pass along the cable ladder. Cables shall be bundled in groups of no more than 24 cables.
2. Hook and Loop wraps should not be used above the drop ceiling or in cable tray except in limited circumstances. The pathway shall support the cables without the use of extra tie wraps.
3. Wraps shall never be used to support cables from building structure, electrical conduits, or lighting systems.
4. Panduit HLT2I or equal.

D. Grounding and bonding of racks and cable ladder
1. Bond each rack and all parts of the cable ladder as 1 ground system.
2. Use Erico Eriflex woven copper grounding braids to attach racks and ladder.
3. Erico # 556700 or other lengths as required.

E. Rack Mounted shelf
1. Install shelves where equipment needs to be installed but is not rack mountable.
2. Identify equipment and depth of equipment and order shelf to match
3. Cantilevered shelves:
   a. 1.75” tall rack mount shelf shall be Startech #Shelf-1U20-FIXED-V
   b. 3.5” high, 14” depth with weight up to 50 lbs. Hubbell #MCCCS1

F. Blank Panels
1. Where there is equipment that needs to be mounted in the rack and needs to be vertically mounted install a blank panel.
2. Blank Panels shall be steel, black in color, Hubbell #MCCBPXXX where XXX is the height of the blank panel.

G. Vertical 19” rack mounting.
1. Provide and install a wall mount 19” rack kit
2. Shall support 19” rack mounting equipment being installed vertically.
3. Shall be deep enough to support 4 Rack units of 1.75” each
4. Shall be Hubbell #WB4 or equal.
5. Mount to plywood on wall or to block wall.

2.07 WALLFIELD EQUIPMENT

A. Plywood for Wallfields:
1. Plywood shall be American Plywood Association (APA), Grade A-C at minimum. Meaning that the “A” side is smooth and paintable, neat repairs are permissible. “C” side allows knotholes to 1 inch and limited splits are permitted. “A” side is used for mounting; “C” side is installed towards the wall.
2. Plywood shall be 3/4-inch-thick and shall come in 4 foot x 8 foot sheets with a quantity of sheets installed as per the detailed drawings.
3. All plywood used for wallfields shall be fire-retardant plywood and shall be stamped as such.
   a. Shall have a Flame-spread rating of 25 or less,
4. Each piece of plywood with one coat of white paint. Paint all edges.
   a. Do not paint over one of the Fireproof stamps on the plywood. Leave this so that the owner can identify that the plywood installed is fire-retardant.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Location of the communications infrastructure shall be finalized in the communications room prior to installation.

B. Locate all equipment to be installed, and make certain that space is available for maintenance and service during the life of the system.

C. If any changes from the drawings are required, the Contractor shall submit a proposed layout of the communications room to the Engineer for approval prior to installation.

3.02 PREPARATION

A. Clean floor prior to installation of the communications racks.

B. Coordinate with all other Contractors and ensure that the locations of all cable tray and conduits are correct and will feed the rack system adequately.

3.03 INSTALLATION OF WALL MOUNTED CABINETS

A. Cabinets mounted to the wall shall be securely attached.
   1. Where the cabinets are to be mounted to a wall, the Contractor shall first install a piece of plywood to be used to mount the cabinet on. Secure the plywood to the wall then secure the cabinet to the plywood and wall where possible.
   2. Review the facilities above a cabinet prior to installation. When possible, cabinets should not be installed below water pipes or other facilities in the ceiling.
   3. Mount the cabinet so that the top of the cabinet is not more than 7 feet AFF.
   4. Check to make sure that the cabinet will be able to fully open from both hinges after installation. Change mounting location to accommodate the opening.
   5. Install support wheels to the cabinet to support the weight of the cabinet when it is closed.

3.04 INSTALLATION OF RACKS

A. All racks shall be square to the walls and installed in a straight line.
   1. Use only 3/8 inch bolts and connectors when constructing the racks and associated cable ladder.
   2. Install vertical cable ladder to the back of each vertical organizer of each rack. When multiple racks are side by side, 1 section of vertical cable ladder can serve both racks.
   3. Install the vertical cable ladder in the center of the vertical organizer. This allows cables to be routed down each side for use by both racks.
   4. Install horizontal sections of cable ladder along the top of the rack. Attach the horizontal sections to the vertical sections as well as the horizontal section of the next rack.
   5. Contact the Engineer prior to final placement of the racks.
   6. After approval of the placement of the racks, secure racks to the floor with anchors. Racks shall be secure after installation.
   7. Use 6 inch vertical organizers as spacers for racks. Attach racks to both sides of the vertical organizer, where multiple racks are required.
   8. Install unistrut “L” brackets to the bottom of the vertical cable ladder to secure the cable ladder to the floor.
   9. Each rack shall have an engraved phenolic label. The label shall be self-adhesive, black with white letters. The label shall be affixed to the front and top of the rack so it is visible while standing in front of the racks. Label shall correspond with the designated rack label as shown in the detailed drawings.
   10. Install woven ground braids between racks and cable ladder for eventual connection to the Telecommunications Ground Bar (TGB).
   11. Remove paint from rack where ground braid is attached to the rack or cable ladder. Use star washers for all ground connections.

3.05 INSTALLATION OF COMM ROOM EQUIPMENT

A. Patch cord organizers shall be installed between all patch panels and electronics.
   1. Horizontal organizers shall be used for routing fiber and copper patch cords between patch panels and electronics.
   2. Refer to Rack layouts on detailed drawings for quantity of organizers to provide.
   3. Organizers shall be installed side by side where multiple racks are installed.
   4. If changes in the rack layout are required, contact the Engineer and get changes approved prior to installation.

B. Tie wraps shall be used sparingly in the overall installation.
   1. Tie wraps shall not be used in the cable tray or above the drop ceiling for support of cables. All cables shall utilize J-hooks, conduits, cable ladder, or cable tray for support in the ceiling area.
   2. Tie wraps can be used to group cables on the cable ladder of the rack systems. Group cables in bundles of no more than 24 cables.
   3. Trim all tie wraps so that the cut edge is smooth.

C. Hook and Loop shall be used sparingly in the overall installation.

1. Hook and Loop should not be used in the cable tray or above the drop ceiling for support of cables. All cables shall utilize J-hooks, conduits, cable ladder, or cable tray for support in the ceiling area.
2. Hook and Loop can be used to group cables on the cable ladder of the rack systems. Group cables in bundles of no more than 24 cables.

D. Power strips shall be installed so that they do not interfere with the cable routing, or the installation of components into the rack.
1. Modular plug for the outlet strip shall be installed at the bottom of the outlet strip.
2. The outlet strip shall plug into 1 of 2 duplex receptacles installed at the bottom of the rack. Refer to the detailed drawings for receptacle locations.
3. Coil any extra cord from the outlet strip and tie wrap it to the bottom of the vertical cable ladder.
4. Securely attach the outlet strips to the back edge of the vertical cable ladder.
5. Electrical outlets are installed by others. Communications Contractor shall be responsible for connecting power strip to the outlets.

E. Shelves and blank panels
1. Install in the rack where required and/or where shown on the drawings.

3.06 WALLFIELD EQUIPMENT

A. Paint plywood with prior to installation on the wall.
1. Plywood shall be installed from 12 inches AFF to 7 feet above the floor or as noted on the drawings.
2. Mount plywood to the wall with screws attached to studs in the wall. Contractor is responsible for securely mounting the plywood to the wall.
3. Grade “A” side of the plywood shall be used for mounting all communications components.
4. If the plywood will cover an electrical receptacle, the Contractor shall cut the plywood to allow access to the receptacle.

END OF SECTION 28 1100

SECTION 28 1150 – COMMUNICATIONS GROUNDING

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. This section includes parts and equipment required for a communications grounding system installation.

1.02 SYSTEM DESCRIPTION

A. The grounding system from the ground bar in each communications room to the electrical ground shall be installed by the Electrical Contractor.
   1. This shall include connection of the ground bar in each communications room to the electrical ground. Shall also include:
      a. Connection of ground cables in the cable tray,
      b. Ground connections to electrical panels,
      c. Grounding of any riser conduits.

B. Telecommunications grounding systems shall be connected to the electrical ground at the Main Distribution panel.

1.03 INSTALL BASED ON STANDARDS INCLUDING

A. NFPA 70-99,
B. National Electrical Code (latest edition adopted by AHJ)
C. TIA-607-C Generic Telecommunications Bonding and Grounding

1.04 COORDINATION

A. Coordinate ground connections to ground bar with Electrical Engineer and Contractor.
B. Coordinate the location of ground bars in the communications room with the Electrical Contractor prior to installation.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Approved equals for ground components are:
   1. Newton.
   2. Erico
   3. Hubbell

2.02 MATERIALS

A. Ground Bar shall be Hubbell #HBBB14210A or equal
B. Compression (crimp) type ground lugs for connection of ground cables shall be Burndy No. YCA series or equivalent.
   1. Use only manufacturer approved crimp tools with all crimp lugs.
C. Ground wire shall be No. 6 AWG for all ground connections from the equipment to the ground bar. Ground wire in plenum areas shall be bare with no insulation. All other ground wires shall have green insulation.
   1. Approved ground cable vendors are Southwire, The Okonite Company, and Pirelli or equal.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Location of the ground bar shall be finalized in the communications room prior to installation.
B. Locate and note all equipment to be connected to the ground system. Routes for ground cables shall be planned prior to final location of the ground bar.
C. Identify location of racks, cabinets, and all electronic equipment. Connections from the ground bar to these are required for a complete ground system.
D. Connect the cable ladder to the ground bar in each communications room. Connect with a #6 AWG ground cable.

3.02 PREPARATION

A. Plan routes of all ground cables.
B. For components that are to be connected to the ground system, remove paint from the connecting point and attach to the ground cable with a star washer.
C. Ground cables shall be connected from the ground bar in each communications room with a No. 6 AWG ground cable. Items to be connected by the Communications contractor include, but are not limited to:

1. Each individual rack and cabinet
2. Cable ladder.
3. Cable tray.
4. Audio Video Systems
5. Protected entrance terminals (PET).
6. Splice cases.
7. Access Control Panels

3.03 INSTALLATION

A. Cabling Contractor shall Install the ground bar to the wallfield.
   1. Coordinate location with other systems.
   2. Work with Electrical contractor to have them connect the ground bar to the electrical service panel and building steel.

B. Ground connections shall meet all applicable codes, and shall be located such that they are accessible for maintenance.
   1. All grounding conductors shall be continuous without splice.
   2. Metal boxes, cabinets and fittings, or noncurrent carrying metal parts of other fixed equipment, if metallically connected to grounded cable armor or metal raceway, are considered to be grounded by such connection. If not connected, they shall be grounded in 1 of the following ways:
      a. By a grounding conductor run with circuit conductors, this conductor may be uninsulated. But if it is provided with an individual covering, the covering should be finished to show a green color.
      b. By a separate grounding conductor installed the same as grounding conductor for conduit and the like.
   3. Metal raceways, cable armor, cable sheath, enclosures, frames, fittings, and other metal noncurrent carrying parts that are to serve as grounding conductors shall be effectively bonded where necessary to assure electrical continuity and the capacity to conduct safely any fault current likely to be imposed on them.
      a. Any nonconductive paint, enamel, or similar coating shall be removed at threads, contact points, and contact surfaces or be connected by means of fittings so designed as to make such removal unnecessary.
   4. Continuity of metal raceway or metallic sheathed cable shall be assured throughout the system.
   5. National electrical code shall be used as guide for grounding in hazardous areas.

C. Ground cables shall be installed in a neat and workmanlike manner.
   1. All cables shall be supported or routed against a wall and attached to the wall. No free-floating cables between components will be allowed.
   2. Fully support ground cable so that it does not sag between connections.
   3. There shall be no sharp bends in the ground cables.

D. Terminate and connect all ground cables with crimp type connectors.
   1. Use star washers on all connections of ground cables to ground bars and racks and equipment.

E. Ground systems shall be tested after installation to ensure proper installation and connectivity.
   1. Test procedures shall be fully spelled out. They shall minimally include, the time and date of the test, name of tester, device used to test ground potential, and test results.
   2. The Contractor shall provide test results, to the Engineer for final approval and sign off.
   3. Ground connections shall be tested at each rack in each communications room. The system shall not be considered complete until the ground tests have been completed and acceptable results are provided.

END OF SECTION 28 1150

SECTION 28 1500 – FIBER CABLING

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. This section includes parts and equipment required for installation, termination and testing of a fiber optic cable backbone.

1.02 SYSTEM DESCRIPTION

A. The fiber optic backbone shall include all components of the system from the patch panels to the backbone fiber and everything in between.

1.03 CONTRACTOR

A. Contractor company shall have a minimum of 3 years' experience installing and testing fiber optic cabling systems.
   1. Unless otherwise specified, multimode and single mode fiber cable must meet the transmission performance parameters as specified in ANSI/TIA/EIA-568-B.3.
   2. Test equipment used under this contract shall be from manufacturers that have a minimum of 5 years' experience in producing field test equipment. Manufacturers must be ISO 9001 certified.
   3. Test equipment shall be capable of measuring relative or absolute optical power in accordance with TIA/EIA-526-14A, "Optical Power Loss Measurement of Installed Multimode Fiber Cable Plant," and TIA/EIA-526-7 Method A, "Measurement of Optical Power Loss of Installed Single Mode Fiber Cable Plant, Insertion Loss Using An Optical Power Meter."
   4. Traces and records shall be provided to the Engineer and Owner in hard (paper) and soft (disk) copy.

1.04 COORDINATION

A. Coordinate work under provisions in Division 1 of these specifications.
B. All fiber cables shall be coordinated with the installation of the telecommunications raceways.
C. Coordinate location of the spare coiled fiber cables with Engineer prior to installation.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Approved vendors for fiber cable are:
   1. Optical Cable Corporation.
   2. General Cable.
   3. Berk-Tek.
   4. Corning
   5. Hubbell
B. Approved vendors for fiber termination equipment are:
   1. Hubbell.
   2. Panduit.
   3. Optical Cable Corporation
   4. Corning

2.02 FIBER CABLE

A. All fiber cables shall be of tight buffered construction. A tight buffered optical fiber shall consist of a central glass optical fiber surrounded by a primary polymer buffer and an optional tight fitting secondary buffer.
   1. The outer jacket of each fiber strand shall be colored according to the fiber color code in TIA 598-B.
   2. Individual multimode fiber strands shall be 50/125μm for the core/cladding measurements.
   3. Individual singlemode fiber strands shall be 9/125μm for the core/cladding measurements.
   4. All fiber strands shall be surrounded by synthetic yarn for added strength and crush resistance.
   5. All fiber installed in plenum rated areas shall be UL listed OFNP.
   6. The outer jacket of the cable shall be surface printed with the manufacturer's identification and required UL markings.

7. All fibers shall be subjected to a minimum fireproof stress of 0.7 GPa (100 kpsi).
8. The minimum bend radius of the cable under full rated tensile load shall be no larger than 15 times the outside diameter of the cable and no more than 10 times the outside diameter of the cable with no load on the cable.
9. Optical and mechanical performance shall not be degraded and the cable shall not be damaged in any way by immersion in ground water.
10. The fiber optic cable shall meet or exceed the requirements of this specification when measured in accordance with the methods of the individual requirements or the following methods as defined in EIA-STD-RS-455.
    a. Fiber dimensions.
    b. Attenuation.
    c. Bandwidth.
    d. Numerical aperture.
    e. Fiber proof test.
    f. Cable bending.
    g. Tensile load
    h. Impact resistance.
    i. Crush resistance.
    j. Attenuation vs. temperature.
11. Manufacturer shall provide ISO 9001 certification.
12. The cable shall withstand an impact force 1500 times per ANSI/TIA/EIA-RS-455 (FOTP-25A).
13. The cable shall withstand compression load of 1800 N/cm per ANSI/TIA/EIA-RS-455 (FOTP-41A).
14. Fiber shall be indoor/outdoor rated based on the areas in which the fibers will be installed. Do not install riser rated fiber through a plenum rated area unless the fiber is inside an EMT conduit.

B. Indoor and outdoor rated, Plenum rated fiber.
1. The multi-fiber sub-cables shall consist of tight buffered optical fibers surrounded by a synthetic yarn strength member and a color-coded flame retardant elastomeric polymer jacket. The strength member shall be composed of individually and precisely tensioned elements such that tensile loads are equally shared by each element.
2. Single-mode indoor/outdoor, plenum rated fiber cable
    a. Wavelength: 1310/1550nm
    b. Industry Standard: ITU-T G.652.D
    c. 1 Gigabit Ethernet Distance: 5 km
    d. 10 Gigabit Ethernet Distance: 10 km
    e. Max Attenuation: .5/.5 dB/km
    f. Singlemode, indoor/outdoor, Plenum rated Yellow jacket: OCC # DZ024TSLA9YP

C. Indoor or outdoor Armored fiber cable.
1. The multi-fiber sub-cables shall consist of tight buffered optical fibers surrounded by a synthetic yarn strength member and a color-coded flame-retardant elastomeric polymer jacket. The strength member shall be composed of individually and precisely tensioned elements such that tensile loads are equally shared by each element.
2. Cable shall be inside of Aluminum Interlocking Armor
3. Single-mode indoor/outdoor fiber cable
    a. Wavelength: 1310/1550nm
    b. Industry Standard: ITU-T G.652.D
    c. 1 Gigabit Ethernet Distance: 5 km
    d. 10 Gigabit Ethernet Distance: 10 km
    e. Max Attenuation: .5/.5 dB/km
    f. Plenum Rated Armored

1) 12-strand Singlemode, OCC # DZ012TSLA9YPI8

2.03 RACK MOUNT FIBER PATCH PANELS

A. 12-36 port, rack mount fiber patch panels.
   1. Rack mount fiber patch panels shall be modular in design. Mounting brackets shall be provided for 12 pack adapters. Adapter packs shall sit horizontally in the panel.
   2. Panels shall mount into standard 19-inch relay racks.
   3. Panels shall be no more than 1-3/4 inch or 1 rack unit high.
   4. Provide splice tray and splice shelf or splice cassettes for termination of all fiber strands.
   5. Fiber panel shall be Hubbell #FPR3SP or equal
      a. Equip with Splice trays as required. Hubbell #Stray12F or Stray24F
      b. Equip with Label Kit, Hubbell #LBLKTFCR1U12
   6. Provide Hubbell Fiber Splice cassettes or pigtails and panels for splicing and termination of all fiber strands. See Below:

2.04 FIBER PIGTAIL SPLICE CONNECTORS

A. All fiber cables shall be terminated with spliced pigtails matching the fiber cable that was installed.
B. LC Style Connectors pigtails
   1. Singlemode connectors shall be LC style.
   2. Provide 1-meter, pre-connectorized pigtails for fusion splicing to each fiber strand.
   3. Singlemode Pigtails shall be Yellow in color
   4. All spicing shall be Fusion splicing. Mechanical splicing is not allowed.
   5. Match the size of the glass in the pigtail to the size of the glass in the fiber.
   6. Work with fiber cable manufacturer on specifying pigtails that exactly match the fiber cable being terminated.
   7. Singlemode LC terminated single strand, fiber pigtails shall be Hubbell #FHPBKR12LC6S or equal.

2.05 FIBER PATCH PANEL ACCESSORIES

A. Fiber stowage ring
   1. Install a ring on the wall near the racks for stowage of 30’ of spare fiber or as noted on the drawings.
   2. Fiber stowage ring shall be Leviton # 48900-OFR.
   3. Label the fiber at the stowage ring with both termination points. Install label Panduit PST-FO or equal

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine all pathways prior to installation of fiber cable.
B. Identify location of racks, and position of fiber patch panels prior to fiber installation.
C. Inspect fiber cable prior to installation for damage during shipping. The Contractor shall be responsible for all damaged or nonfunctional fiber cables. If any strands of a fiber cable are not working, the Engineer has the right to order the complete replacement of the entire fiber cable.

3.02 PREPARATION

A. Contractor shall designate the location of the spare coil of fiber at each end of the run prior to installation.

3.03 INSTALLATION

A. Installation of fiber cable shall be by a trained installer.
   1. All fiber, if not installed inside cable tray, shall be attached to the building structure with conduit clamps or supports a minimum of every 5 feet.
   2. Fiber shall be continuous from end to end, no splices are allowed unless specifically noted.
   3. At each termination point of the fiber, the Contractor shall provide a service coil consisting of a minimum of 30 feet of fiber cable.
   4. Contractor shall adhere to all manufacturer’s recommended pull tensions during installation.

5. As part of the as-built drawings, provide the actual footage of each fiber cable installed. Mark this on the drawings.
6. Any fiber strands that do not pass a sufficient signal light signal will be identified as noncompliant, and the Engineer has the right to order the complete replacement of the fiber cable by the Contractor.
7. Where fiber cable passes vertically through a building, the fiber cable shall be supported against the wall or from the ceiling a minimum of every 5 feet.
8. Do not exceed recommended bend radius of fiber cable during or after installation.

B. Fiber patch panels shall be located at the top of the relay rack or cabinet at which they are installed. Install on wall or inside cabinet where shown for wall mounted fiber panels.
1. Provide patch panels as described on the contract drawings or additional panels as required to terminate all fiber strands of all fiber cables.
2. Install fiber panels in the top of the rack where possible
3. If a splice shelf is required for splicing of fibers, install the shelf directly below the associated patch panel.
   a. Provide and install splice panels as required for splicing of all pigtails to terminate the fiber strands.
4. Route fiber cable into side of the panel. Provide a wrap-around label at this location to identify the fiber cable as it enters the fiber panel.
   a. Label the fiber cable just outside of the fiber panel with a yellow fiber optic cable label, Panduit No. PST-FO.
5. The sheath of the fiber cable shall extend to the side of the panel. Individual fibers or subgroups shall not be seen outside of the panel, except for the single mode bundles.
6. Fibers shall be installed in the adapter packs in color code order. For vertical mounted 12 pack adapters, top to bottom then left to right. In panels where the couplers are horizontally mounted, left to right for each 12 pack, then top to bottom. Contact the Engineer with any questions.
7. All individual fiber strands shall be neatly installed in the back of the panel after termination. Provide a minimum of 4 feet of spare fiber in the back of each panel. This spare shall be coiled in a Figure 8.
8. Secure the fiber to the entrance of the patch panel with tie wraps.
9. After installation and termination of the fiber cable, install labels on the patch panel showing what strand each connector is connected to, and where the overall fiber cable is terminated at the other end.
10. Attach a self-adhesive clear plastic sleeve to the inside of the Plexiglass cover of the rack mount panel. Slide in a laser printed label showing all information about the fiber cable.
11. Label door of wall mount panels to detail the fiber cable type, strand count and termination locations

C. Fiber cables shall be terminated with fusion spliced Pigtails.
1. All Singlemode and multimode fiber cables shall be terminated with a pre-terminated fiber optic pigtail which matches the diameter and type of fiber being installed.
2. Fusion splice all pigtails to the fiber cables. Terminate each strand of the fiber cable.
3. Each strand shall be thoroughly cleaned and all coverings shall be removed prior to splicing
4. To cleave the fiber, use the method and equipment recommended by the manufacturer of the fusion splicer that will be used.
5. Fibers shall be properly aligned prior to splicing.
6. The splicer used shall be able to inject light directly into the fiber just after it is spliced, and provide an estimate of the loss through the splice.
7. After splicing, a heat shrink tube with a rigid skeleton shall be used to protect the splice. Coordinate this heat shrink tube with the splice tray to be installed in the splice shelf. Heat shrink tubes shall fit into the grooves in the splice tray.
8. Loss through the splice shall be no more than .15dB.

9. Fiber pigtails shall be labeled with a self-laminating, laser printed, wrap around label at the connector. The label shall detail the strand count of the fiber cable, the buildings and rooms in which the fiber is terminated and the color and strand number the pigtail is spliced to.

24MM/12SM
WRT#234-OLS #021
Brown Fiber # 16

END OF SECTION 28 1500

SECTION 28 1600 – CAT-6/6A CABLING

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. This section includes parts and equipment required for installation, termination, and testing of user communications cables.

1.02 SYSTEM DESCRIPTION

A. The horizontal cabling consists of all systems from the user faceplate, to the patch panel in the communications room, and all connections in between.

B. Products and installation detailed in this section shall comply with all applicable requirements.

1. ANSI/TIA-568-C.0, "*Generic Telecommunications* Cabling *for Customer Premises*",
2. ANSI/TIA-568-C.1, "*Commercial Building Telecommunications Cabling Standard*",
3. ANSI/TIA-568-C.2, "*Balanced Twisted-Pair Telecommunication Cabling and Components Standard*", ANSI/TIA-568-C.3, "*Optical Fiber Cabling Components Standard*",
4. ANSI/TIA-568-C.4, "*Broadband Coaxial Cabling and Components Standard*",
5. ANSI/TIA/EIA-569-B Commercial Building Standard for Telecommunications Pathways and Spaces
6. IA-606-B: Administration Standard for the Telecommunications Infrastructure of Commercial Buildings including all Updates and Addenda.
7. TIA-607-C: Generic Telecommunications Bonding and Grounding (Earthing) for Customer Premises.
8. IEEE 802.3af PoE • Ratified in 2003 • 15.4W at the PSE, with min of 12.95W available to the PD
9. IEEE 802.3at PoE+ • Ratified in 2009 • 34.2W at the PSE, with min of 25.5W available to the PD
10. IEEE 802.3af PoE • Ratified in 2003 • 15.4W at the PSE, with min of 12.95W available to the PD
11. IEEE 802.3at PoE+ • Ratified in 2009 • 34.2W at the PSE, with min of 25.5W available to the PD
12. IEEE 802.3bt -Amendment 2. Ratified in 2018 PoE standards powering all 4 pairs:

1.03 COORDINATION

A. All cables shall be coordinated with the installation of the telecommunications raceways.

B. Coordinate all user cables with the furniture to be installed in the building. Make any adjustments prior to cable being installed.

C. Contractor shall walk the site during construction and shall verify all raceways are being installed as required to install the user data cables. Walk the site prior to drywall being installed or floors being installed when Floor boxes are being installed.

1.04 STANDARDS

A. Cabling shall be installed in accordance with NEC code for grouping/bundling of cables in relation to Type 3 and Type 4 PoE

B. Install as per NEC 840.160 in reference to bundling cables:

AWG	Numberof 4-Pair Cables in a Bundle																				
	1			2-7			8-19			20-37			38-61			62-91			92-192		
	Temp Rating			Temp Rating			Temp Rating			Temp Rating			Temp Rating			Temp Rating			Temp Rating		
	60°C	75°C	90°C	60°C	75°C	90°C	60°C	75°C	90°C	60°C	75°C	90°C	60°C	75°C	90°C	60°C	75°C	90°C	60°C	75°C	90°C
26	1.0	1.0	1.0	1.0	1.0	1.0	0.7	0.8	1.0	0.5	0.6	0.7	0.4	0.5	0.6	0.4	0.5	0.6	NA	NA	NA
24	2.0	2.0	2.0	1.0	1.4	1.6	0.8	1.0	1.1	0.6	0.7	0.9	0.5	0.6	0.7	0.4	0.5	0.6	0.3	0.4	0.5
23	2.5	2.5	2.5	1.2	1.5	1.7	0.8	1.1	1.2	0.6	0.8	0.9	0.5	0.7	0.8	0.5	0.7	0.8	0.4	0.5	0.6
22	3.0	3.0	3.0	1.4	1.8	2.1	1.0	1.2	1.4	0.7	0.9	1.1	0.6	0.8	0.9	0.6	0.7	0.8	0.5	0.6	0.7

C. Cables shall be installed with no more than 24 cables in a single J-hook. Install additional J-hooks as required.

D. If cables are to be bundled/grouped in larger bundles then the cable shall be LP listed per UL.

E. All cables shall be no smaller than 23 AWG.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Approved vendors for copper user cables are:

1. Panduit
2. Hubbell
3. Belden
4. CommScope
5. Mohawk
6. Superior Essex
7. Paige

B. Approved vendors for CAT-6 termination equipment are:

1. Hubbell.
2. Panduit (Net Key not allowed)
3. Belden
4. CommScope

2.02 CAT-6 CABLING

A. All UTP user/cabling installed shall be CAT-6 rated or above.

1. Category 6 cabling shall consist of 4 pairs of unshielded twisted pair, 23 AWG cables.
2. All CAT-6 cables shall be installed in cable tray or supported by J-Hooks.
3. Individual pair shall be marked in the standard 4 pair color code of blue/blue-white, orange/orange-white, green/green-white, and brown/brown-white.
4. Each cable shall be marked sequentially with the footage of the cable. Each cable shall also be marked with the manufacturer of the cable and the type of cable installed or the cable part number.
5. Cable and all connectors and patch panels shall meet or exceed the following electrical and physical requirements:

DC RESISTANCE (max)	23 AWG
Ohms/100m @ 20°C	9.38ohms
DC RESISTANCE UNBALANCED (max)	
Individual Pair %	5%

CHARACTERISTIC IMPEDANCE	
Frequency (f)	Ohms
1-500 Mhz	100 ±15

DELAY SKEW (max)	
ns/100m	45

NOMINAL VELOCITY OF PROPAGATION (NVP)	
% Speed of light	72

INPUT IMPEDANCE	
Frequency (f)	Ohms
1.0-100 Mhz	100 ±15
100-350 Mhz	100 ±20
350-500 Mhz	100 ±25

REFERENCE ELECTRICAL CHARACTERISTICS

FREQ (MHz)	INSERTION LOSS (dB/100m)		NEXT (dB/100m)		ACR (dB/100m)	PS-NEXT (dB/100m)		PS-ACR (dB/100m)	ELFEXT (dB/100m)	PS-ELFEXT (dB/100m)	RL (dB)
	avg	max	avg	min	min	avg	min	min	min	min	min
.772	1.7	1.8	82	76.0	74.2	77	74.0	72.2	–	–	–
1.0	1.9	2.0	80	74.3	72.3	75	72.3	70.3	67.8	64.8	20.0
4.0	3.6	3.8	71	65.3	61.5	66	63.3	59.5	55.8	52.8	23.0
8.0	5.1	5.3	67	60.8	55.5	62	58.8	53.5	49.7	46.7	24.5
10.0	5.7	6.0	65	59.3	53.3	60	57.3	51.3	47.8	44.8	25.0
16.0	7.3	7.6	62	56.2	48.6	57	54.2	46.6	43.7	40.7	25.0
20.0	8.1	8.5	61	54.8	46.3	56	52.8	44.3	41.8	38.8	25.0
25.0	9.1	9.5	59	53.3	43.8	54	51.3	41.8	39.8	36.8	24.3
31.25	10.2	10.7	58	51.9	41.2	53	49.9	39.2	37.9	34.9	23.6
62.5	14.8	15.4	53	47.4	32.0	48	45.4	30.0	31.9	28.9	21.5
100.0	19.0	19.8	50	44.3	24.5	45	42.3	22.5	27.8	24.8	20.1
155.0	24.2	25.2	47	41.4	16.3	42	39.4	14.3	24.0	21.0	18.8
200.0	27.8	29.0	46	39.8	10.8	41	37.8	8.8	21.8	18.8	18.0
250.0	31.5	32.8	44	38.3	5.5	39	36.3	3.5	19.8	16.8	17.3
300.0	35.0	36.4	43	37.1	0.7	38	35.1	--	18.3	15.3	16.8
350.0	38.2	39.8	42	36.1	--	37	34.1	--	16.9	13.9	16.3
400.0	41.3	43.0	41	35.3	--	36	33.3	--	15.8	12.8	15.9
500.0	47.0	48.9	40	33.8	--	35	31.8	--	13.8	10.8	15.2
550.0	49.7	51.8	39	33.2	--	34	31.2	--	13.0	10.0	14.9

6. All cables installed above a drop ceiling or fixed ceiling shall be Plenum Rated
7. CAT-6, 4 pair cabling shall be plenum rated unless specifically noted.

Cable Use	Manufacturer	Color	Part number	Rating
Data Cabling	Mohawk	Blue	M58281	Plenum
Security Camera	Mohawk	Green	M58286	Plenum
IP/POE locks at doors	Mohawk	White	M58280	Plenum
Audio/ video	Mohawk	Black	M58289	Plenum
Backbone	Mohawk	Purple	M58290	Plenum
USB	Mohawk	Orange	M58288	Plenum
Paging -MDOC	Mohawk	Brown	M58756	Plenum
Underground	Mohawk	Black	M58772	Underground

Shielded Underground Rated	Belden	Black	OSPF6F	Underground / Shielded

8. Ensure that cable passes all CAT-6 tests after installation.

2.03 CAT-6A CABLE -SMALL DIAMETER

A. Unshielded Twisted Pair (UTP) CAT-6A cable

B. Shall meet standards:
   1. ANSI/TIA-568-C.2 AND ISO/IEC 11801:2002 CATEGORY 6A ELECTRICAL CHARACTERISTICS.

C. Cable shall consist of:
   1. 23 AWG solid bare copper insulated conductors, assembled into 4 pairs cabled together with a assembly: flexweb core separator
   2. Jacket shall include footage markers
      a. Outer diameter shall be .25”
   3. The cable shall be plenum rated for use in air handling ducts and spaces in accordance with article 800 of the National electrical code (NEC).
   4. Shall be US Listed C(UL)US OR C(ETL)US TYPE CMP UL OR ETL VERIFIED CAT 6A
   5. Supported Applications
      a. IEEE 802.3 10BASE-T (ETHERNET),
      b. 100BASE-T (FAST ETHERNET),
      c. 1000BASE-T (GIGABIT ETHERNET),
      d. ANSI.X3.263 FDDI
      e. TP-PMD, IEEE 802.5 4 AND 16 Mbps TOKEN RING,
      f. 550 MHz BROADBAND
      g. VIDEO AND ATM UP TO 4.8 Gbps.
      h. IEEE 802.3an 10gbase-t (10 gigabit Ethernet),
      i. Access points and PoE / PoE+.

D. Physical Characteristics
   1. Bending radius: 1” (25 mm) min)
   2. Pulling tension: 25 lbf (110 n) max
   3. Operating temp.: -20°c to +75°c (-4°f to +194°f)
   4. Storage temp.: -20°c to +75°c (-4°f to +194°f)
   5. Installation temp.: 0°c to +50°c (+41°f to +122°f)

E. Shall meet or exceed following testing parameters.

REFERENCE ELECTRICAL CHARACTERISTICS

FREQ (MHz)	INSERTION LOSS (dB/100m)	NEXT (dB/100m)	PS NEXT (dB/100m)	ACRF (dB/100m)	PS ACRF (dB/100m)	RETURN LOSS (dB)	PROP. DELAY (ns/100m)	ALIEN CROSSTALK PS ANEXT (dB/100m)	ALIEN CROSSTALK PS AACRF (dB/100m)
	max	min	min	min	min	min	max	min	min
1.0	2.1	74.3	72.3	67.8	64.8	20.0	575.0	67.0	67.0
4.0	3.8	65.3	63.3	55.8	52.8	23.0	557.0	67.0	66.2
8.0	5.3	60.8	58.8	49.7	46.7	24.5	551.7	67.0	60.1
10.0	5.9	59.3	57.3	47.8	44.8	25.0	550.4	67.0	58.2
16.0	7.5	56.2	54.2	43.7	40.7	25.0	548.0	67.0	54.1
20.0	8.4	54.8	52.8	41.8	38.8	25.0	547.0	67.0	52.2
25.0	9.4	53.3	51.3	39.8	36.8	24.3	546.2	67.0	50.2
31.25	10.5	51.9	49.9	37.9	34.9	23.6	545.4	67.0	48.3
62.5	15.0	47.4	45.4	31.9	28.9	21.5	543.6	65.6	42.3
100.0	19.1	44.3	42.3	27.8	24.8	20.1	542.6	62.5	38.2
155.0	24.1	41.4	39.4	24.0	21.0	18.8	542.1	59.6	34.4
200.0	27.6	39.8	37.8	21.8	18.8	18.0	541.5	58.0	32.2
250.0	31.1	38.3	36.3	19.8	16.8	17.3	541.3	56.5	30.2
300.0	34.3	37.1	35.1	18.3	15.3	16.8	541.1	55.3	28.7
350.0	37.2	36.1	34.1	16.9	13.9	16.3	540.9	54.3	27.3
400.0	40.1	35.3	33.3	15.8	12.8	15.9	540.8	53.5	26.2
500.0	45.3	33.8	31.8	13.8	10.8	15.2	540.6	52.0	24.2

SWEEP TESTED TO 500 MHz

F. CAT-6A, 4 pair cabling shall be plenum rated unless specifically noted.

Cable Use		Manufacturer	Color	Part number	Rating
Wireless AP		Mohawk	Yellow	M59230	Plenum
Audio/ video		Mohawk	Black	M59234	Plenum
USB		Mohawk	Orange	M59229	Plenum

G. Ensure that cable passes all CAT-6A tests after installation.

2.04 UTP JACKS

A. 8-position modular jacks for termination at user and at the patch panel. Match cable color except where noted on drawings.

1. Each jack shall be an individually constructed unit and shall snap mount in an industry standard keystone opening (.760 inches x .580 inches).
2. Jack housings shall be high impact 94 V-0 rated thermoplastic.
3. Jack housings shall fully encase and protect printed circuit boards and IDC fields.
4. Modular jack contacts shall accept a minimum of 1000 mating cycles with 5.0 milliohm (maximum) increase over initial with the use of an FCC compliant plug.
5. Modular jack contact wires shall be formed flat for increased surface contact with mated plugs.
6. Modular jack contacts shall be constructed of beryllium copper for maximum spring force and resilience.
7. Contact plating shall be a minimum of 50 micro inches of hard gold in the contact area over 50 micro inches of nickel.
8. Jack termination shall follow the industry standard 110 IDC.
9. Jacks shall have a designation indicating CAT-6 or CAT-6A as required.
10. Jacks shall utilize a paired punch down sequence. Cable pair twist shall be maintained up to the IDC, terminating all conductors adjacent to its pair mate to better maintain pair characteristics designed by the cable manufacturer.
11. Jacks shall terminate 22-26 AWG stranded or solid conductors.
12. Jacks shall terminate insulated conductors with outside diameters up to .050 inches.
13. Jacks shall be compatible with single conductor, 110 impact termination tools.

14. Jacks shall include translucent wire retention stuffer cap that holds terminated wires in place and allows the conductors to be visually inspected in the IDC housing.
15. Jacks shall be compatible with EIA/TIA 606A color code labeling.
16. Jacks shall accept snap on icons for identification or designation of applications.
17. Jacks shall be marked for T568A and T568B wiring schemes. TIA 568B wiring shall be used in all terminations throughout the communications system.
18. All CAT-6 modular jacks and panels shall meet or exceed the following transmission characteristics:
    a. Jacks shall be designed for 100 Ohm UTP cable termination.
    b. Jacks shall be UL verified for TIA/EIA Category 6 electrical performance.
    c. Jacks shall be UL listed 1863 and CSA certified.
    d. Jacks shall be manufactured by an ISO 9002 registered manufacturer.
19. CAT-6, 8-pin modular jacks shall be:
    a. Data Jacks shall be Hubbell # HXJ6OW or equal. Office White.
    b. Data Jacks for Security Cameras shall be Hubbell #HXJ6GN-Green
    c. Data jacks for backbone connectivity shall be Hubbell #HXJ6P-Purple
    d. Data Jacks for IP/POE locks at doors shall be Hubbell #HXJ6W -White
    e. Data Jacks for Audio and Video connections shall be:
        1) Hubbell #HXJ6BK-Black
    f. Data Jacks for USB connections shall be Hubbell #HXJ6OR-Orange
    g. Data Jacks for Paging Systems shall be Hubbell #HXJ6BN-Brown
20. CAT-6A, 8-pin modular jacks shall be:
    a. Data jacks for Wireless Access Points shall be Hubbell #HJU6AY-Yellow

2.05 FACEPLATES

A. Modular Standard flush mount faceplates shall support all the jacks and connectors required.
1. Faceplates shall be UL listed and CSA certified.
2. Faceplates shall be constructed of high impact thermoplastic or stainless steel. See drawings for specific requirements.
3. Faceplates shall be 2-3/4 inches wide x 4-1/2 inches high (69.8 mm x 114.3 mm) for single gang, and 4-1/2 inches x 4-1/2 inches (114.3 x 114.3 mm) for double gang.
4. Faceplates shall be available to mount 1, 2, 3, 4, or 6 jacks in a single gang and up to 12 jacks in a double gang configuration.
5. Faceplates shall provide for TIA/EIA 606 compliant station labeling.
6. Faceplates shall have plastic covers over the mounting screws that can be replaced with a clear plastic window over a printable paper insert.
7. Each plate shall be fully configured with modular inserts. There shall be no open spaces in the faceplate.
8. Match the color of the modular inserts to the color of the faceplate. All faceplates and inserts shall be office white unless otherwise noted.
9. Single gang plastic faceplate shall be Hubbell # IMF1OW.
10. Double gang plastic plate shall be Hubbell # IMF2OW.
11. Sing Gang, stainless steel, modular faceplates shall be Hubbell #IMSS1
12. Double Gang, stainless steel, modular faceplates shall be Hubbell #IMSS2
13. Each single gang plate has 3 faceplate units (FPU’s) available to install inserts. Double gang plates have 2 sides, each with 3 FPU’s.
14. Equip plates with the following parts as directed on the construction drawings.

FPU	ITEM	PART NUMBER
	Blank Jack	SFB10
.5	Blank	IMB05OW
1	Blank	IMB1OW
1.5	Blank	IMB15OW
1	1 Port Flat	IM1K1OW
1	2 Port Flat	IM2K1OW
1.5	1 Port Angled	IM1KA15OW
1.5	2 Port Angled	IM2KA15OW

B. Integrated furniture outlets, GFI style inserts and plates, and standard 106 style inserts and plates.
   1. These may be required at some surface raceway location. Field verify prior to ordering.
   2. The Contractors shall identify which type of outlet or frame is required at each location throughout the system.
   3. Match the outlet with the faceplate required.
   4. GFI, more commonly referred to as style line inserts, are rectangular and fit in a rectangular plate used for GFI receptacles.
   5. 106 style inserts are configured to fit in a common duplex electrical receptacle faceplate. The inserts hold 2 or 4 modular jacks.
   6. Each type of modular furniture has certain requirements for its voice and data modules. The Contractor shall coordinate with the furniture installer and provide the correct faceplate and outlets to match the color and style of the furniture.
   7. For all connections that do not have a faceplate with a location for a laser printed paper label, the Contractor shall provide an engraved lamacoid label detailing the location number of each cable.
   8. GFI/Style line Stainless Steel Plates shall be:
      a. Single Gang, Hubbell #SS26
      b. Double Gang, Hubbell #SS262
      c. Three Gang, Hubbell #SS263
   9. GFI/Style line Plastic plates without a Label Field shall be:
      a. Single Gang, Hubbell #NPJ26GY-Gray
      b. Double Gang, Hubbell # NPJ262GY-Gray
      c. Three Gang, Hubbell # NPJ263GY-Gray
   10. GFI/Style line Plastic Plates with Label Field shall be:
      a. Single-Gang, Hubbell #IFP126OW -Office White
      b. Double-Gang, Hubbell #IMFP2OW -Office White
   11. GFI/Style Line Inserts shall be:
      a. Provide an insert to support all Modular jacks that are to be installed.
      b. One Port Hubbell #NS611W
      c. Two port, Hubbell # NS612W
      d. Three port, Hubbell # NS613W,
      e. Four port, Hubbell # NS614W
      f. Six port, Hubbell # NS616W.
      g. Blank, Hubbell #NS620W
   12. 106 style inserts shall be:
      a. Two port, Hubbell #BR106W

b. Four Port, Hubbell #Q106W

13. Examples





a. 106 Style GFI/Style-Line

C. Brush opening plate

1. Where routing AV cables through an open backbox the contractor shall install a “brush” plate that covers the backbox and allows cable to pass thru
2. Provide a single or double gang cover plate with GFI openings.
3. Single-gang plates shall be Hubbell #SS26 with Leviton #41078-DBW, White in color or equal
4. Double-gang plates shall be Hubbell #SS262 with Two (2), Leviton #41078-DBW, White in color or equal

D. Wall mount phone plates shall be stainless steel.

1. Each plate shall be equipped with a CAT-6, 8 port modular jack.
2. Each plate shall be equipped with stainless steel studs for mounting a wall mount telephone to the plate.
3. Single gang wall mount phone plate shall be Hubbell #SP6F or #SP6R base on telephone type. Coordinate with owner prior to ordering.

2.06 SURFACE MOUNT BOXES

A. Provide surface mount boxes for termination of cables as shown on the drawings.

1. Install a surface mount box at location for termination of the modular jacks.
2. One port surface box shall be Hubbell #HSB1OW.
3. Two port surface box shall be Hubbell #HSB2OW
4. Four Port Surface box shall be Hubbell #HSB4OW
5. For all plenum rated ceilings and areas the contract shall provide plenum rated surface mount boxes. For Hubbell products. Add a “P” to the end of the part number.

2.07 CABLE SUPPORTS

A. All cables shall be supported in the ceiling a minimum of every 5 feet. Support can be provided by installing cable inside cable tray or conduit, or by installing J-hooks or bridle rings with saddles every 5 feet.

1. J-hooks
   a. Hooks shall provide a smooth steel or plenum rated plastic, support for cables as they route through the ceiling. Shall be rated for the ceiling area where they are being installed. Verify any plenum rated areas and only install plenum rated supports
      1) Metal J-hooks supports shall have a galvanized finish.




2)
3) Shall be UL listed, ultimate static load limit 50 pounds rated to support Category 5e and higher cables, and optical fiber cables.

b. If required, assemble to manufacturer recommended specialty fasteners, including beam clips and flange clips.

c. Acceptable products shall be:
1) CADDY #CAT HP series with retainer hooks or Panduit J-Pro series supports
1) Minimum square inch size of support for cables on the J-hook shall be 2.25”
2) Caddy HP21xxxx series or
3) Panduit JP2Wxxxx series or equal

d. Provide with interfaces and clamps required to support J-Hooks from the building structure.

2. Bridle Rings

a. Bridle Rings with saddles shall provide a smooth plenum rated plastic, support for cables as they route through the ceiling. Shall be rated for the ceiling area where they are being installed. Verify any plenum rated areas and only install plenum rated supports
1) Bridle ring supports shall have a zinc plated finish.
2) Bridle ring saddles shall be yellow in color and plenum rated. Shall meet CAT-6 and CAT-6A cable support standards.



3)

b. If required, assemble to manufacturer recommended specialty fasteners, including beam clips and flange clips.

c. Acceptable products shall be:
1) 1.5” diameter, Minerallac 646RS series or equal
2) 2” diameter, Minerallac 648RS series or equal

d. Provide with interfaces and clamps required to support Rings from the building structure.

B. Ceiling supports

1. J-Hooks and Rings shall be supported from the building structure. This includes connections to the walls, concrete ceiling, building steel and contractor installed vertical supports that are attached to the building structure.
2. Contractor can install threaded rod or other supports such as Unistrut or Drop ceiling tiles to support the J-hooks and subsequently the cables.
3. Supports shall be installed every 5 feet and shall be installed to keep cables from resting on pipes, ducts, structural steel, lights, ceiling grid, electrical conduits and any other structure that cable could possibly rest against.
4. Provide threaded rod and associated hardware required to support all J-Hooks
   a. Paint threaded rod Yellow prior to installation
5. Above Drop ceilings, or accessible hard ceilings, the contractor can install support wire to support the J-Hooks.
   a. Drop ceiling support wire shall be 12 AWG minimum
   b. Attach to building structure.
   c. Attach to drop ceiling grid.



   d.
   e. Paint support wire Yellow prior to installation.
   f. Provide associated hardware required to support all J-Hooks.



   g.
6. No more than 24 data cables in each J-hook. No more than 32 able sin each 2” Bridle Ring. Provide additional hooks and rings as required to support all cables.

2.08 RACK MOUNTED PATCH PANELS

A. Patch panels for termination of UTP cabling shall be provided to terminate all cables installed in the building.
B. All patch panels shall be installed into 19” racks and/or cabinets as shown on the drawings.
C. Provide panels to terminate all cables even if the panels are not specifically shown on the rack layout drawings.

1. Provide the quantity and color of Modular jacks to match the color and quantity of all cables installed.

D. Panels shall be steel and shall allow mounting of all CAT-6 an CAT-6A jacks. Panels shall be blank panels that accept all modular jacks.

E. CAT-6 patch panels for mounting in a 19-inch rack or cabinet. Shall be;
1. Panels shall be made of black anodized aluminum, in 24 and 48 port configurations.
2. Panels shall accommodate 24 ports for each rack mount space or "U" (1U = 44.5 mm [1.75 inch]).
3. Panels shall be manufactured with a rolled edge at the top and bottom for stiffness.

F. 24 port empty patch panels shall be Hubbell #HPJ24 or equal
1. Panels shall have rear cable support bar for strain relief which shall clip to the rear of the patch panel or to the rear of the rack rail.
2. Each 24-port patch panel shall be equipped with one (1) rear cable organizer. Organizer shall be Hubbell #HPRCMB or equal.
3. Ports shall be marked 1-24 on top of the openings by factory.
4. Label all Panels for the panel, communications room and rack with a large laser-printed label.

2.09 PASS THRU'S

A. Where no pass-thru is provided by others the contractor shall install conduit or UL listed wall pass thru's sized as required to route all cables through all walls.

B. Pass thru's shall be EMT conduit or another UL listed rated device.

C. Install thru all drywall, block, concrete walls and through any floors required to be penetrated

D. Conduit shall be supported mechanically from the wall or floor structure. After installation, the raceway shall be firestopped to meet the requirements of the wall or floor.

E. Install a sticker on the wall, next to the pass thru, listing the UL approved method that was used to firestop the pass thru or conduit.

2.10 PATCH CORDS

A. Contractor shall provide one patch cord for each data cable installed. Patch cords shall be at the communications room.
1. Provide a patch cord for each CAT-6 or CAT-6A cable installed

B. Patch cords shall match the type of cables installed. Provide CAT-6 patches for CAT-6 cables. Provide CAT-6A patches for CAT-6A cables

C. Patch cords shall be 8" or 12" long and shall match the color of the cable/jack they are being plugged into.
1. Provide Yellow Patch Cords for Wireless Access Points
2. Provide Green Patch Cords for Security Cameras
3. Provide Blue Patch Cords for all other data cable connections.

D. Patch cords shall be 28 AWG, small diameter cords
1. CAT-6 cords shall be Panduit #UTP28SP8IN* where * is the color
2. CAT-6A cords shall be Panduit #UTP28X8IN* where * is the color

E. Patch cords shall be 28 AWG, small diameter cords
1. CAT-6 cords shall be Hubbell #HCL6xxyy where xx is the color and yy is the length. 01 length is 12"
2. CAT-6A cords shall be Panduit # HCL6Axxyy where xx is the color and yy is the length. 01 length is 12"

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine all pathways prior to installation of all cables.

B. Identify locations of all user conduits and backboxes prior to cable installation.
   1. Walk the site during conduit installation and ensure that all boxes are installed where required for termination of all cables.
   2. If any missing locations are not noted during electrical raceway installation the contractor shall be required to fish the wall or install surface raceway to support the cable terminations
C. The Engineer or the Owner has the right to make adjustments to the location of any outlet to a new location within 7 wall-feet of the original location. If the change is made prior to final cable termination, and prior to any raceway being installed, then the changes shall be a no cost change to the contract.
D. Identify all locations where cable will route through furniture raceway or other nonstandard conduit or raceway installation. Make arrangements to install and terminate all cables in accordance with TIA/EIA 568 standards.

3.02 PREPARATION

A. Locate main path for all cables and install J-hooks where cable tray or raceway is not provided.
B. Coordinate with other trades to install a clear, straight path down major corridors for the routing of user cables back to the communications closet.
C. Plan installation of cables along cable ladder of rack system in communications room. All cable shall be neatly routed in groups of no more than 24 cables.

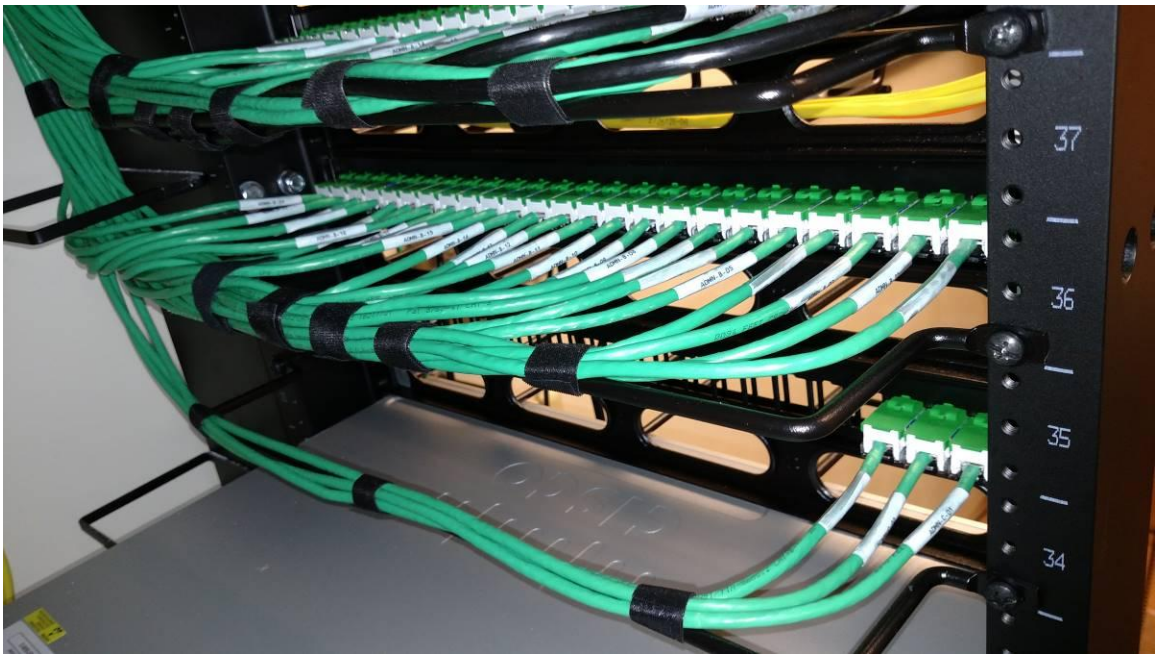
3.03 INSTALLATION

A. CAT-6 and/or CAT-6A cabling shall be installed according to TIA/EIA 568 standards, including all updates and addenda.
   1. When installing CAT-X cables, care shall be taken to avoid crimping or bending the cable past the manufacturer's recommended bend radius.
   2. During installation, the cables shall not be pulled across the ceiling tiles or the structure of the building. This may cause damage to the cable jacket.
   3. Adhere to all pulling tensions and bend radii during installation. Excessive pulling or bending can cause the cable to fail tests after installation. Any cable that does not pass the certification tests after installation shall be fixed or replaced at the Contractor's expense.
   4. All cables shall route neatly in the ceiling. Whether they route in cable tray or J-hooks, the cables shall be neat and orderly.
   5. Cables shall not be laying on or against the building structure. Cables shall not be laying on or against electrical or HVAC pipes.
   6. Cables shall not be installed between the building structure and corrugated steel of the roof deck.
   7. There shall be no more than 24 cables in each J-hook. Provide additional J-hooks as required.
   8. Support all cables at a minimum of every 5 feet.
   9. Provide a short coil of extra cable where the cable enters the vertical conduit. The coil shall consist of no less than 1-1/2 feet.
   10. Provide enough slack in the backbox to fully remove the faceplate and jack and allow work to be done on the cable.
   11. When installing cables in the communications room, all cable shall route neatly through the cable tray and cable ladder.
   12. When transitioning from the ceiling area to the cable ladder of the rack system, all cable shall route through conduits or be attached to vertical section of cable ladder.

The Contractor shall provide the conduits shown and any additional conduits or cable ladder required to neatly transition cables from the ceiling to the rack.

13. Bundle cables in groups of no more than 24 cables as it routes along the cable ladder.
14. Cables shall route down each side of a rack for termination. Split each panel into 2 sides. The first 12 positions on a panel are on the left, and positions 13 through 24 are on the right. Route the cables for panel positions 1 through 12 down the left cable ladder and route the cables for positions 13 through 24 down the right cable ladder.
15. Each patch panel shall utilize a rear organizer for holding the cables as they route to the punchdown field.
16. Cables shall be bundled in groups of 4 as they route through the rear cable organizer.
17. When terminating cables, ensure that the smallest amount of jacket is removed from the final termination point of the cables.
18. Pair twists shall be maintained up to the IDC jack for all the cables.
19. Provide a service loop of the cables on the vertical cable ladder. The loop shall extend no less than 1 foot below the termination point on the patch panel. Route the cables 1 foot below the patch panel, and then back up to the panel. This will provide room for future moves and additions to the rack.
20. Each cable shall have a self adhesive, self laminating, laser printed label at each end. The label shall show the location identifier of that cable. Labels shall be installed no more than 4 inches from the termination point of the cable.

B. All work on the project shall meet all applicable state, federal, local and industry codes and be installed according to the requirements of he Authority Having Jurisdiction (AHJ).



Detail 01. Proper routing and support of cables on rear organizer. Where possible route 12 cables from right side and 12 cables from left side. This rack in picture did not have right side organizer.



Detail 02. Cable routing from above ceiling to cable ladder and to racks Route all cables neatly.

C. CAT-6 and CAT-6A data jacks shall be installed at the user end of each UTP cable installed in the system.
   1. Jacks shall be installed to provide minimal signal impairment by preserving wire pair twists as close as possible to the point of mechanical termination.
   2. Jacks shall be installed per manufacturer's instructions and properly mounted in plates, frames, housings, or other appropriate mounting devices.
   3. Jacks shall be installed such that cables terminated to the jacks maintain minimum bend radius of at least 4 times the cable diameter into the workstation outlet. Cables shall be terminated on jacks such that there is no tension on the conductors in the termination contacts.
   4. See drawings for the color requirements of all modular jacks.

D. Faceplates shall be mounted straight and level with the floor and walls of the building.
   1. Jacks and/or connectors shall be terminated to the appropriate cable and inserted in the correct orientation into the faceplate prior to the mounting of the faceplate.
   2. Jacks shall be inserted into the faceplate left to right, then top to bottom. 2 gang plates shall be labeled left to right, then top to bottom for each gang.
   3. Cable slack shall be stored behind the faceplate in such a way that allows the minimum bend radius of the cables to be maintained as per the following:
   4. Care shall be taken when mounting the faceplate to avoid crimping or kinking the cables.
   5. Faceplates shall be securely mounted to a surface mounted housing, a recessed box, or box eliminator bracket.
   6. Each faceplate shall be labeled with laser printed paper inserted behind the clear plastic label strips.

7. The label shall show the location identifier of the faceplate and the letter designation for each cable. The label shall be as large a font as possible and easily readable.
8. Each faceplate comes with a label strip at the top and the bottom.

E. When utilizing 106 style or GFI/Style-Line brackets, the Contractor shall provide self adhesive labels detailing which cable is at each position.
1. 106 plates and GFI plates will primarily be located in floorboxes or surface raceway.
2. The contractor shall coordinate the faceplates required with the actual floorboxes installed by the electrical contractor.
3. Provide the quantity of GFI and 106 style plates required.

F. Surface Mount boxes
1. Modular Jacks and/or connectors shall be terminated to the appropriate cable and inserted in the correct orientation into the surface mount box.
2. When the surface mount jack is mounted above the ceiling the cable shall be coiled and the cable and surface mount box shall be kept off of the ceiling grid
3. Attach the coil to the building structure with a plenum rated tie-wrap.
4. Label each surface mount box for the cable number. Also, install a wrap-around label on each cable.
5. When attaching a surface mount box to a piece of furniture or to a power pole the contractor shall drill a hole in the furniture/pole that is larger than the hole on the back of the surface box.
6. Screw the surface box to the furniture or to the pole. Adhesive only solutions are not adequate.

G. Proper support of cables is of paramount importance when installing a cable infrastructure. All cables not in conduit or cable tray shall be supported via J-hooks a minimum of every 5 feet.
1. Routes of cables shall be parallel or perpendicular to the walls of the building.
2. Install the J-hooks to minimize changes in the level of the cables as they route through the J-hooks.
3. Do not install more than 50 cables in any 1 J-hook. Provide additional hooks where more than 50 cables route along a main route.
4. All communications shall route as high in the ceiling as possible while still being accessible and staying away from other utilities.
5. When installing the cable through the J-hooks, they shall all have relatively the same droop between hooks. All cables shall be installed neatly and squarely.
6. Secure the J-hooks to the building structure with beam clamps and threaded rod as required to support the cables.
7. J-hooks shall never be attached to drop ceiling support wires. Cables shall never be supported by drop ceiling wires.

H. CAT-6 patch panels shall be installed in the racks.
1. Panels shall be installed to provide minimal signal impairment by preserving wire pair twists as closely as possible to the point of mechanical termination. The amount of untwisting in a pair as a result of termination to the modular jack at the patch panel shall be no greater than a 1/2 inch (13 mm).
2. Panels shall be installed per manufacturer’s instructions and properly mounted to a rack, cabinet, bracket, or other appropriate mounting device.
3. Panels shall be installed such that cables terminated to the panel can maintain minimum bend radius of at least 4 times the cable diameter into the IDC contacts.

Cables shall be terminated on the panels such that there is no tension on the conductors in the termination contacts.

4. Each patch panel shall have a rear cable organizer for routing cable from the vertical cable ladder to the patch panel. 1 organizer for each row of 24 cables.
5. The label for each outlet on the panel shall be the same as the wraparound label on each end of the cable.
6. Each label shall line up directly below or above the outlet on the panel. Misaligned labels will not be permitted.

I. Patch Cords

1. Provide patch cords into the communications room where they are to be installed
2. Mark the box with the date they are placed in the room and quantity of each type of patch cable.
3. Send picture of the box to the designer and owner

END OF SECTION 28 1600

SECTION 28 1705 – CLOCK SYSTEM -IP-POE

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. This section provides a project overview and general project and Contractor requirements for the Internet Protocol (IP) Power over Ethernet (PoE) clock system

1.02 DESCRIPTION OF PROJECT

A. The building shall receive an entirely controlled master clock system and associated IP clocks. CAT-6 cables shall be used from the clock to the comm room for connectivity. See drawing and specs for contractor that is to install the cables
   1. The system shall consist of, but not be limited to clocks and antenna systems that transmit the time to the clocks.

1.03 CONTRACTOR

A. The Contractor shall accept complete responsibility for the installation, certification, and support of the system. Contractor must show proof that they have the certifying manufacturer's support on all of these issues.

B. All work shall be performed and supervised by technicians and project managers who are qualified to install the clock system and to perform related tests as required by the manufacturer in accordance with the manufacturer's methods.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. The manufacturer of the wireless master clock system shall have been designing, manufacturing, and installing systems for a period of no less than 3 years.

B. Approved manufacturers for the paging bell system are:
   1. Sapling
   2. Others as equal.

2.02 MATERIALS

A. Master Clock System:
   1. The Contractor shall provide a fully functional, IP based controlled master clock system.
   2. The clock system shall consist of all software and electronics required to provide accurate time at each clock. This shall include, but not be limited to, software, configuration, wiring, and all clocks located throughout the building.
   3. All clocks shall be connected to the Ethernet network and controlled through a network attached NTP server.

B. Digital IP Clocks:
   1. All clocks shall be digital clocks with green digits. Red Digits are not allowed
   2. Clocks shall have integral receivers that attach to the Ethernet network and derive power from the PoE on the Ethernet cable.
   3. Provide custom backbox for flush mounting in new walls.
      a. Provide backbox to electrical contractor or cabling contractor who is installing raceway.
   4. Provide custom backbox for surface mounting in existing walls. Provide raceway to accessible ceiling from the backbox.
   5. Clocks shall be self-correcting at a minimum of each hour.
   6. Clocks shall have the following specifications or better:
      a. Power over Ethernet (802.3af protocol)
      b. Power and synchronize clocks through one Ethernet cable using RJ45 connector
      c. Control all of your settings like Daylight Saving Time and countdown functions through an easy-to use web interface
      d. Scheduled dimming schedules for digital clocks
      e. Edit a specific clock’s settings or apply settings to the entire clock system through one location
      f. Available in different sizes
         A) 2.5” (6.35 cm) display

B) 4” (10.16 cm) display
C) 4-digit display
D) 6-digit display

g. Automatic bi-annual Daylight Savings Time
h. Alternating time/date in both U.S and International formats
i. 12 or 24-hour display
j. Four levels of adjustable brightness

7. Digital PoE, IP clocks shall be Sapling SBP-3100 series, includes surface mount housing:
   a. Sapling Digital, IP, 3100 Model, 2.5", 4 Digits, PoE, Green Display, Surface Mount #SBP-31S-254-0G
   b. Sapling Digital, IP, 3100 Model, 4.0", 6 Digits, PoE, Green Display, Surface Mount #SBP-31S-406-0G

C. PoE Ethernet switch
1. Contractor shall provide the Ethernet switch in each comm room to connect all clocks that are installed.
2. Ethernet switches shall provide power to drive each clock
3. Provide switch to connect to the owners Ethernet network.

PART 3 - EXECUTION

3.01 GENERAL

A. Contractor shall be familiar with the location(s) where the work will be done. No additional compensation will be made for items the Contractor claims he was not aware of during bidding.

B. Work Area:
1. All work areas shall be cleaned at the end of each day. All debris shall be cleaned and removed from the site and disposed of in the approved container for the site.
2. All equipment shall be moved out of common areas and stored in the Contractor’s lay down area, or in other approved storage locations on site.
3. Any work that is low hanging, or may otherwise impede the general use of the space, and cannot be removed shall be flagged and cordoned off by the Contractor.

C. All equipment and parts shall be installed in a neat and workman like manner. Good installation principles shall be used throughout the project.

3.02 INSTALLATION

A. Clock Configuration.
1. Configure each clock to point to the same NTP servers.
2. Configure for each clock.
   a. Configure each clock with an IP address
   b. Name all clocks in the system
   c. Configure dimming schedules of each clock.
3. All clocks shall be set to exactly the same time. The Contractor shall verify the correctness of the clocks.
4. The clock system shall run for a minimum of 2 weeks prior to being turned over to the Owner. During that time, the Contractor shall keep a daily log of the time and ensure that the system is keeping the correct time each day. Any variations from the accepted standard time shall be noted and shall be corrected by the Contractor. The system shall not be turned over to the Owner until 2 straight weeks have passed during which the system has been shown to keep the correct time.

B. Clock Connectivity
1. Confirm with the cabling contractor (if cables are being installed by another contractor) how the cables shall be installed and terminated.
2. Provide with all patch cables required at each end. At clock and at comm room
3. Plug in each clock and confirm power and network connectivity

C. Surface Mount Clocks
1. Identify location of backboxes with electrician prior to installation.
2. Install surface mount boxes to the backboxes in the wall.

3. Connect network cables

D. Clocks mounted in the Gymnasium shall be protected by polycarbonate covering.

E. All clocks shall be installed straight and level.

END OF SECTION 28 1705

SECTION 28 1810 – PAGING AND BELL SYSTEM-IP SPEAKERS WITH CLOCK

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. This section provides detailed specifications for the new audio Paging/Bell system in the building.

1.02 DESCRIPTION OF PROJECT

A. The school shall receive new audio paging/bell/clock equipment

B. The district has an existing Singlewire Informacast system that shall be expanded to support the new and renovated space(s).

C. Where new equipment is being installed it shall include but not be limited to:

1. Analog and IP speakers, cabling, headend equipment, an interface to the telephone system and programmable control software.
2. System shall be two-way with talkback for each classroom. Teacher shall be able to have a two-way conversation with the person calling into the room through the speakers.
3. Integral to the system shall be a programmable bell system that will work through the paging system speakers. The bell system shall allow multiple bell schedules and programming of bell schedules by the owner.
   a. The owner has an existing Singlewire #informacast system that shall be expanded
4. Speakers shall be installed where shown on the drawings. The different paging zones shall be configured individually for occupied spaces.
5. Control of the zones and bells and other configuration parameters shall be via a Web Page interface. The control system shall allow dynamic change of paging and bell groupings as well as the bell schedule.
6. The paging system shall be fully integrated into the telephone system so that announcements can be made from any phone within the school.
7. The paging system shall derive its time from the internet or from a national standard time device. The paging system shall be set to exactly the same time as the clock system.

1.03 SHOP DRAWINGS

A. Shop drawings shall be submitted by the Contractor for approval prior to installation of the work. The shop drawings shall show all data relating to the structural, electrical, wiring diagrams, etc.

B. The wiring and connectivity to be added to any racks and wallfields shall further be shown. Changes shall be reflected on existing layouts where applicable. For all new racks or wallfields required, the Contractor shall show a total elevation view of the layout.

C. Shop drawing shall specifically detail speaker zones and their associated zone designations.

1.04 CONTRACTOR

A. The Contractor shall accept complete responsibility for the installation, certification, and support of the system. Contractor must show proof that they have the certifying manufacturer's support on all of these issues.

B. All work shall be performed and supervised by technicians and project managers who are qualified to install Integrated paging/bell systems and cabling and to perform related tests as required by the manufacturer in accordance with the manufacturer's methods.

C. The vendor (including Subcontractor(s) if any) shall have a proven track record in paging and bell system configuration and installation. This must be shown by the inclusion of details of

at least 3 projects involving the installation of like sized systems that have been completed by the vendor in the last 2 years.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. The manufacturer of the paging/bell system shall have been designing, manufacturing, and installing systems for a period of no less than 5 years.

B. Approved manufacturers,

1. Software shall be Singlewire, #informacast
2. Hardware shall be #Atlas IED

2.02 PAGING/BELL SYSTEM

A. The actual system being installed shall be based around the Singlewire Informacast software

B. Hardware shall be Atlas IED.

C. The paging system and associated bell system shall provide at a minimum the following functions and features:

1. The integrated paging/bell system shall allow administrators to make announcements or sound tone events to any individually wired speaker or configurable group of speakers.
2. Shall be a talk-back, two-way system that supports calling from the telephone system and allows two-way communications between the caller and person in the room. This communication shall be through the in-room speaker.
3. Administrators shall be able to access the speakers through any telephone tied directly into the telephone system or designated paging system handset.
    a. Shall allow two-way communications thru the owner telephone system.
4. System shall interface with any telephone system, thus allowing an upgrade or replacement of the telephone system without suffering a requirement to replace, or lose any feature of, their paging system. Any system that limits system features based upon any selected telephone system, and/or is proprietary to one or only a few telephone systems shall not be acceptable.
    a. Shall be completely SIP (Session Initiation Protocol) compatible.
5. Pass codes shall be available to restrict access to the system if the owner deems them necessary.
6. Speaker zones shall be software assignable to different owner required groups. These groups shall be independent of the time/bell groups.
7. Provide time/bell schedules with the ability to automatically administer 8 or more schedules per building at any given time.
    a. Each scheduled event shall be capable of utilizing any one of 50-user defined internal tones/auxiliary sources. Automatically administered schedules shall be capable of simultaneous operation.
    b. Schedule administration, modification and creation functions must be available through administration Web Interface on the owners PC.
    c. Systems that do not allow the management of schedules with a web interface shall not be acceptable.
    d. Bell tones shall be through windows Media files or equal and shall be fully customizable by the owner.
        1) Work with the owner to load their chosen tones or announcements.
8. Distribution of general announcements shall be possible from any administrative telephone, staff telephone, or classroom telephone. The system shall be capable of

providing all-call, group call, multiple group call, individual classroom calls or dial-on-the-fly page groups.

9. The system shall provide for the distribution of emergency announcement(s) from any authorized telephone to all areas furnished with a loudspeaker. Emergency announcements shall have the highest system priority
10. The system shall be a global switching system, providing eight (8) unrestricted simultaneous private telephone paths.

D. The electronics of the paging/bell system shall have the following capabilities:
   1. The owner has an existing Server or appliance based that is capable of handling up to the number of points shown on the drawings or more as the system connectivity requires.
   2. Software and hardware shall be capable of connecting to:
      a. IP speakers
      b. SIP telephone system
      c. SIP endpoints
      d. Dry contact inputs and outputs. (see drawings and specs for interface requirements)
      e. Desk based IP microphones
      f. Auxiliary analog audio input. Shall stream audio to the SIP speakers
   3. System functionality must include the capability to manually distribute any number of tones or pre-recorded files via pushbuttons, contact closure, webpage scheduler or dial up tones from any administrative telephone or other input buttons. These tones shall be customizable with respect to cadence, type, and duration.
   4. The system shall have the ability to control all system relays. All relays must be software programmable with the flexibility to change as required.
   5. The system shall be capable of adding auxiliary inputs such as an IPod, MP3 player or CD player to play over any group of speakers at a certain time. The auxiliary input shall be assignable just like bell tones and announcements.
      a. Shall be assignable to play during pre-set times of the day and for a pre-set duration.
      b. Shall be able to play music or other audio input or streamed audio.
   6. See the drawings for the paging zones required.
   7. Shall tie to the national time clock to keep the bell system on the correct national time. Provide equipment and cabling required to keep the bell system on the correct time.

E. The actual system electronics (where required for integration to analog speakers or dry contacts) shall be capable of being mounted in a standard 19-inch relay rack or being mounted on a communications wallfield.
   1. Power shall be from a standard 110V AC outlet or PoE network power.
   2. Shall be Ethernet Attached to owner’s data network.
   3. The system shall manage announcements and messages using dynamically routed data on a standard POE Ethernet Network connections.
   4. The system shall manage other peripherals including Digital Communications Stations, Network Power Amplifier Systems, Input/Output Devices, Zone Controllers and IP End Points.
   5. The system shall include internal support for (4) logic inputs, (4) relay outputs, and (2) balanced audio inputs plus:
      a. Line input
      b. Mic Input

6. The system shall manage dynamic requests for live and delayed announcements, pre-recorded and assembled messages, actions, defined events, and two-way full duplex intercom connections.

F. The interface for control of the time events and paging groups shall be via a PC with an Ethernet connection to the network.
   1. Control software shall be installed and reside on three (3) administrator's PC's. The software shall guide the user through the setup and control of all aspects of the paging and bell system.
   2. Provide a 3, or 4-digit numbering plan, thus allowing the zone to be custom numbered as per the owner's requirements.
   3. Individual groups of speakers wired in sequence shall be assignable to a distinct number. The system shall have the capability of assigning numerous groups of wired speakers to one dialing group. All groups shall be programmed by the Contractor prior to acceptance of the system.

2.03 MASS NOTIFICATION, EMERGENCY ALERTS AND ROUTING PAGING/COMMUNICATIONS

A. Contractor shall provide a complete solution for mass notification, emergency alerts and paging system and clock system that supports internal communications

B. The system shall include software to support the connection of the IP Telephone system to the software

C. This software shall integrate at a network level with the existing telephone system and shall distribution audio to IP/SIP endpoints and analog systems.

D. The software shall support I/O integration between different systems.

E. The software shall include and support:
   1. Mobile device notification and event triggering
   2. Two-way messaging and audio communications thru audio speakers
   3. Multimedia push notifications, and support for
   4. Geofencing for mobile devices.
   5. Unlimited creation of live, pre-recorded, or scheduled broadcast events
      a. Activations initiated from on or off-premise devices
      b. Multimodal notifications to desktop devices, mobile devices, overhead speakers, email, loud horns, strobes, digital/LED signs, and more
   6. Integration with SMS services to alert via text messages
   7. Out-of-the-box integrations with automated alerts and early-warning systems
   8. Geo-location controls to ensure mobile recipients receive relevant information based on their current location
   9. Multilingual text-to-speech engine support to translate dynamic text into intelligible audio broadcasts
   10. One-touch building lock downs triggered via silent alarms using integrated panic buttons or dialing a set number
   11. Automatic sending of alerts from external early-warning systems to everyone across the organization, facility, or campus
   12. Creation of school bell schedules and daily announcements

F. Shall allow and support multiple bell schedules and these shall be assignable based on a calendar.

G. Mobile Device system shall be supported and shall include:
   1. Mobile app for media-rich notification push
   2. Allows for two-way notifications
   3. Enables On and Off-premise alerting

4. Create custom choices for mobile assistance menu
5. Enables sharing details with voice recording and images
6. Geofencing support for controlling alerts based upon current location
7. Integration with third-party SMS services for large-scale text notification

H. System shall be integrated with following manufacturers
1. Atlas IED
2. Valcom
3. CyberData
4. Algo

I. Software shall be virtualized on the owners existing server platform

J. Software shall be Singlewire, #Informacast or equal.

2.04 ANALOG SPEAKERS

A. Speakers for all drop-ceiling areas, unless otherwise noted shall be 8 inch speakers that fit directly into the drop ceiling tile.
1. Speaker shall be an 8-inch loudspeaker with a painted white baffle.
2. Each speaker shall have a 6oz. magnet.
3. Sensitivity shall be 95dB at 4ft/1W.
4. Speaker voltage shall be 25 or 70 volt.
5. Provide a tile bridge with each speaker for installation in a standard drop ceiling.
6. Provide a backcan for each speaker.
7. Speaker shall have taps at 1/8W, 1/4W, 1/2W, 1, 2 and 4 watts.
8. Shall be capable of talkback through intercom/paging system.
9. Each speaker shall have an individual volume control on the speaker.
10. Paging system speakers for drop ceilings shall be Atlas Sound # SD72WV or equal.
11. Where the speaker shall be mounted flush into the drywall the contractor shall provide a backbox for the speaker.

B. Speakers for indoor areas where there is no drop ceiling shall be installed inside a backbox that provides support for the speaker when mounted directly to the building structure.
1. Speaker shall be an 8-inch loudspeaker with a painted white baffle and backbox.
2. Each speaker shall have a 10oz. magnet.
3. Sensitivity shall be 92dB at 1M/1W.
4. Speaker primary voltage shall be 70Volt.
5. Shall be capable of talkback through intercom/paging system.
6. Provide all mounting hardware required to attach speaker and backbox to the building structure.
7. Speaker shall have 70 volt taps at .25, .5, 1.2 and 4 watts.
8. Paging system speakers for drop ceilings shall be Atlas Sound # SBMS or equal.

C. Speakers for exterior, gymnasium, and mechanical spaces shall be horn type speakers:
1. Horns for the exterior of the building shall be 15-watt horns that are weather-resistant.
2. Each horn shall be capable of being mounted to a standard double-gang backbox. Speaker cables shall route through the base of the speaker and shall not be exposed.
3. All horns shall be white in color and be capable of being positioned anywhere in a 360-degree axis.
4. Exterior 30-watt horns shall be Atlas Sound GA-30T or equal.

2.05 70 VOLT PAGING AMPLIFIER / ZONE CONTROLLER -SIP ENABLED

A. Where there are to be existing speakers that remain or where new analog speakers are to be installed, the contractor shall provide and install a SIP enabled zone controller/amplifier and connect to the analog audio speakers.

B. Shall be rack or shelf mounted. Provide shelf where the device is not rack mounted.
C. Amplifier shall support SIP input from the Ethernet network.
D. Shall support multicast receive input.
E. 25 watt minimum output at 8 Ohm or 70 volt
F. Control Board with amplifier:
    1. The amplifier / control board shall receive announcements and messages using dynamically routed data on a standard Ethernet Network.
    2. It shall include a Single-Channel Class D Topology amplifier with Primary and Secondary Outputs capable of producing 25-watts RMS when using an IEEE 802.3at compatible PoE+ switch or 24VDC local power supply.
    3. Interconnect shall be via female RJ-45 connector mounted to the PCB.
    4. Shall include (2) logic inputs, (1) relay output, (1) Auxiliary Unbalanced line level audio input and (1) Unbalanced line level audio output.
    5. The Auxiliary Line Level input shall include an auto mute function that is activated when a broadcast is sensed from the control application.
G. Single Zone Controller shall be Atlas IED #IP-ZCM1RMK. Include rack mount kit for each device
H. Dual Zone Controller shall be Atlas IED #IP-ZCM2RMK. Include rack mount kit for each device

2.06 IP SPEAKERS WITH CLOCK AND STROBE -WALL MOUNT

A. Speakers for all ceiling areas, unless otherwise noted shall be 8-inch speakers that are mounted based on their installation location.
B. These speakers shall be used for the following installation types:
    1. Wall mount with custom mount box
C. Speaker/clock/strobe shall meet the following requirements:
    1. The speaker shall be an 8" Coaxial driver with low-frequency reproducer cone shall be a full 8" (203mm) in diameter and the high frequency reproducer cone shall be 3" (76mm) in diameter.
    2. The woofer shall have a 10oz. (260g) ceramic magnet; the tweeter shall have a 2.35oz. (67g) ceramic magnet.
    3. Control Board with amplifier:
        a. The amplifier / control board shall receive announcements and messages using dynamically routed data on a standard Ethernet Network.
        b. It shall include a Single-Channel Class D Topology amplifier with Primary and Secondary Outputs capable of producing 25-watts RMS when using an IEEE 802.3at compatible PoE+ switch or 24VDC local power supply.
        c. Interconnect shall be via female RJ-45 connector mounted to the PCB.
        d. Shall include (2) logic inputs, (1) relay output, (1) Auxiliary Unbalanced line level audio input and (1) Unbalanced line level audio output.
        e. The Auxiliary Line Level input shall include an auto mute function that is activated when a broadcast is sensed from the control application.
    4. The unit shall incorporate an integrated microphone to allow full duplex talkback communication functionality based upon chosen software platform.
    5. Clock and Messaging:
        a. The unit shall incorporate a High-Resolution Back-Lit color LCD display with viewable dimensions of 8.66" (221mm) wide x 2.23" (57mm) high.
        b. Shall display correct time.
        c. Shall allow custom messages to be played on the screen.

6. Strobe/Flasher
    a. The unit shall incorporate a LED flasher with viewable dimensions of 0.5" (13mm) height x 3.5" (89mm) wide.
    b. The LEDs shall be able to produce RGB color spectrum with brightness of 83-lux (Red), 545-lux (Green), 90-lux (Blue), 570-lux (White).
    c. It shall have the capability of multi-speed flash rate and will be software controllable.
7. Connectivity to Software
    a. All control functionality shall be determined via software.
    b. It shall be compatible with:
    c. AtlasIED's GCK,
    d. Syn-Apps' Revolution,
    e. Singlewire's InformaCast
    f. and SIP standalone operation.
8. Combo speaker/clock and LED Flasher shall be Atlas IED #IP-SDMF or equal
9. Equip with Backbox
    a. Angled Backbox, Atlas IED #IP-SEA-SD
    b. Straight Backbox, Atlas IED #IP-SEST-SD
    c. In-Wall recessed Backbox, Atlas IED #IP-FEST-SD

2.07 IP SPEAKERS WITH CLOCK AND STROBE -DUAL-SIDED, WALL/CEILING MOUNT

A. Speakers and Clocks for wall/Ceiling mount, dual-sided installation in hallways, ETC

B. Description:
1. Dual-sided, IP Endpoint Visual System shall consist of a factory assembled double sided wall or ceiling mount enclosure containing 2 LCD displays that can display
2. time and date as well as scrolling text.
3. The model shall also feature LED flashers located below the display can be used to alert room occupants of an incoming scrolling text message in accordance with ADA
4. compliance.
5. The unit shall incorporate 3" loudspeaker drivers on each side of the display.

C. Speaker/clock/strobe shall meet the following requirements
1. 3" (76mm) in diameter full range transducer
2. Control Board with amplifier:
    a. The amplifier / control board shall receive announcements and messages using dynamically routed data on a standard Ethernet Network.
    b. It shall include a Single-Channel Class D Topology amplifier with Primary and Secondary Outputs capable of producing 25-watts RMS when using an IEEE 802.3at compatible PoE+ switch or 24VDC local power supply.
    c. Interconnect shall be via female RJ-45 connector mounted to the PCB.
    d. Shall include (2) logic inputs, (1) relay output, (1) Auxiliary Unbalanced line level audio input and (1) Unbalanced line level audio output.
    e. The Auxiliary Line Level input shall include an auto mute function that is activated when a broadcast is sensed from the control application.
3. Clock and Messaging:
    a. The unit shall incorporate a High-Resolution Back-Lit color LCD display with viewable dimensions of 8.66" (221mm) wide x 2.23" (57mm) high.
    b. Shall display correct time.
    c. Shall allow custom messages to be played on the screen.
4. Strobe/Flasher

a. The unit shall incorporate a LED flasher with viewable dimensions of 0.5" (13mm) height x 3.5" (89mm) wide.
b. The LEDs shall be able to produce RGB color spectrum with brightness of 83-lux (Red), 545-lux (Green), 90-lux (Blue), 570-lux (White).
c. It shall have the capability of multi-speed flash rate and will be software controllable.

5. Combo wall or ceiling mount, dual sided speaker/clock and LED Flasher shall be Atlas IED #IP-DDS or equal

D. Connectivity to Software for all clocks and IP speakers
1. All control functionality shall be determined via software.
2. Speakers shall be compatible with:
a. AtlasIED's GCK,
b. Syn-Apps' Revolution,
c. Singlewire's InformaCast
d. and SIP standalone operation.

2.08 AUXILIARY EQUIPMENT

A. Cables:
1. The contractor shall install all cables required for connectivity of each speaker zone throughout the building. All cabling routed above the drop ceiling shall be plenum rated.
2. Install cabling required for connection of the paging/bell system to the microphone and auxiliary audio inputs.
3. All cabling required for complete system functionality and control and interface with the telephone system shall be installed, labeled and terminated by the contractor.
4. Speaker Wire for analog speakers:
a. The Contractor shall size the speaker wire for the distance between the amplifier and the speaker, as well as the impedance of the speaker.
b. Speaker wire resistance shall not exceed 7 percent of the speakers' impedance.
c. Speaker wire shall be no smaller than 18 AWG.
d. Speaker wire shall be high conductivity, copper cable. Cable shall be of single pair, stranded construction. Cable shall be 2 parallel cables, black in color and 1 of the conductors shall be marked for identification at each end.
e. Cable shall be a minimum of 99.95 percent copper.
f. Provide plenum rated wire when the cable will route through a plenum area. Contractor shall be responsible for identifying plenum areas.
g. Speaker cables for these systems shall be homeruns from the speaker to the terminal strip. There shall be no splices in the cable.
1) 18 AWG plenum Speaker cable shall be West Penn #25224B
2) 16 AWG plenum Speaker cable shall be West Penn #25225B

2.09 ETHERNET NETWORK ELECTRONICS

A. Ethernet switchers are not part of the paging system bid category.
B. Contractor shall install patch cables at the speaker and at the Ethernet switch in the communications room
C.

PART 3 - EXECUTION

3.01 GENERAL INSTALLATION

A. Contractor shall be familiar with the location(s) where the work will be done. No additional compensation will be made for items the Contractor claims he was not aware of during bidding.

B. Work Area:
   1. All work areas shall be cleaned at the end of each day. All debris shall be cleaned and removed from the site and disposed of in the approved container for the site.
   2. All equipment shall be moved out of common areas and stored in the Contractor's lay down area, or in other approved storage locations on site.
   3. Any work that is low hanging, or may otherwise impede the general use of the space, and cannot be removed shall be flagged and cordoned off by the Contractor.

C. All equipment and parts shall be installed in a neat and workman like manner. Good installation principles shall be used throughout the project.

D. All cables routed above the drop ceiling or in the ceiling area shall be installed square to the building. Diagonal cable runs are not permissible.

E. If in the course of the work, the Contractor damages, marks, or misplaces any ceiling tiles the Contractor shall repair, and or replace the ceiling tile to the original condition.
   1. the Engineer shall decide if ceiling tiles have been damaged, and based on the Contractor's proposed fixes, shall decide the best course of action to repair any damage done by the Contractor to the ceiling tiles.

F. It shall be the responsibility of the Contractor to repair any damage done to the structure or finishes in the building by the Contractor. The building shall be returned to its original condition prior to final sign off of the project.

G. The Contractor shall be responsible for locating the speakers of the audio systems in each room. The speakers shall be installed to provide complete coverage with no "dead" spots. Approximate locations are shown on the drawings, the Contractor shall review these and advise the Engineer of any proposed changes prior to installing/ordering speakers. If no changes are suggested the contractor shall be responsible for coverage and meeting all specifications

3.02 CAT-6 CABLING INSTALLATION

A. Install the CAT-6 data cables for support of the Paging IP devices.

B. Coordinate all locations of devices with the cabling contractor if that work is not part of the paging contract.

C. Where installing a speaker outside, provide outdoor rated CAT-6 patch cable and weatherproof all connections. See manufacturer of the speakers for connectivity. Provide weatherproof connectors. Seal all junction points at the building

3.03 8 OHM/25/70 VOLT CABLING INSTALLATION

A. At some locations the IP Paging system shall feed a group of 25/70 volt speakers. See drawings for these speakers and zones.

B. Provide and install speakers and plenum rated speaker cabling.

C. All cabling for connection of the audio devices and any 25/70 volt speakers in the system shall be routed above the drop ceiling or in other raceways as required. No speaker cabling shall be visible other than in the communications room.
   1. 25/70 volt Paging speaker cabling shall be terminated on terminal blocks on the communications wallfield.
   2. All 25/70-volt speaker cabling shall be labeled at each end and at each interconnection point for those cables that serve multiple speakers. The labels shall display the extension number of the group of speakers that are connected. Along with the extension number, the label shall reflect the room if it is a specialized use room, such as ART, GYM, CAF, etc.

3. 25/70-volt Speaker cables shall be routed through the ceiling and supported the same as voice and data UTP cabling is supported. Cables shall route through cable tray or J-hooks.
4. All speaker cables shall be supported a minimum of every 5 feet. No cables shall be supported directly by the building structure, conduit, or mechanical piping.
5. Cables shall be terminated in sequence on the terminal blocks according to extension/room number.
6. Speaker cables shall not be in the same J-hooks as data or telephone cables. Provide additional J-hooks as required.

3.04 SYSTEM INSTALLATION

A. The electronics and components of the paging/bell system shall be in the communications room or where directed by the owner.
1. All components shall be mounted in rack/cabinet.
2. Locate the components as required for connections to power and the ground bar.
3. Ensure that the components are securely mounted to the wall or in the rack/cabinet on a shelf.
4. The Contractor shall install all patch cables required for connection of the components to the Ethernet network.

B. The control software shall be installed on three (3) administrator's PC as directed by the Owner.
1. The control software shall be fully configured and shall be installed with any cabling or associated software required to connect it to the paging/bell system.
2. Meetings shall be held by the Contractor that includes the Owner and the Engineer. During the meetings, the Contractor shall provide all possibilities for configuration of the system to the Owner. Decisions shall be made on speaker/bell groupings, a numbering scheme, naming, etc.
a. See drawings for the extent of the zones and how to connect the speakers. In example; each hallway on each floor shall be a separate zone. Other zones would include the cafeteria, gymnasium, administration offices etc.
3. The Contractor shall be fully responsible for configuring the system per the Owner's requests. This configuration shall be done on site and shall be attended by 2 or more of the Owner's Representatives. This will allow the Owner to better understand the interface and control of the system.
4. All configurations shall be recorded on a spreadsheet that notes the speakers, the room numbers, extensions, and the extension numbers of all the different groupings of speakers. The spreadsheet shall be up to date at the time of acceptance by the Owner and shall be printed. Handwritten spreadsheets are not acceptable.
a. Provide spreadsheet to the owner for their records
5. Work with the owner to determine all IP addresses for each speaker, server and end point devices.
6. Input all names of zones and each individual speaker's into the system.

C. Bells
1. The bell system shall be completely configured by the contractor.
2. Work with the owner to define the different bell schedules and input and label those schedules. These shall include but not be limited to:
a. General class schedule
b. Half-day schedule
c. Pep rally schedule

d. Two-hour delay in start of school schedule

3. Work with the owner to input numerous .wav files that can be used for bell tones.
4. Make the system capable of playing music during passing time if the owner wishes. Configure which zones music will be able to be heard from.

3.05 SPEAKER/CLOCK INSTALLATION

A. Work with the owner on IP addressing of all devices.
   1. Record IP address of each speakers and endpoint in a spreadsheet in Excel.
   2. Work with the owner on the IP addressing scheme.
   3. Set all IP address in each speaker and endpoint device.
   4. Provide and install a patch cable at the communications room.

B. Speakers mounted in the drop ceiling shall be fit into the ceiling supports. Provide a tile bridge for each speaker.
   1. Speakers shall be located to provide maximum coverage possible in each room or each area. Changes from the drawings in the location of speakers are acceptable but must first be approved by the Engineer.
   2. Contractor shall work with the ceiling installer and others prior to and during installation of the speakers. The Contractor shall identify the ceiling tiles that will not need to be installed because a speaker will be installed in those spaces.
   3. The cable connecting to the speaker shall be supported directly over the speaker from a J-hook. The Contractor shall provide a CAT-6 patch cable so that the speaker can be lifted from the tile and moved without causing a disconnection of the cable.

C. Speakers in rooms with no drop ceiling shall be mounted directly to building structure.
   1. The speakers shall be mounted in a backbox that entirely covers the back of the speaker.
   2. The backbox shall be mounted securely to building structure. It shall be mounted so that the sound is not impeded by obstructions between the speaker and the listener.
   3. Provide a CAT-6 patch cable for connection of the speaker to the CAT-6 network cable. A coil of at least 5 feet of cable shall be left at each speaker so that they can be removed from the backbox without disconnecting the speaker.
   4. The grill of the speaker and the backbox shall be painted to match the existing ceiling color.
   5. Install a conduit or raceway to route the speaker cable from the speaker to the accessible drop ceiling in the hallway.

D. Horn style speaker shall be mounted to a backbox or building structure for support.
   1. Horn style speakers mounted outside
      a. Drill thru the wall into the building.
      b. Install a conduit thru the wall and a backbox on the outside of the building.
      c. Weatherproof the conduit and wall. Seal between the base of the horn and the backbox. The seal shall be by an epoxy or other water resistant substance.
   2. Horn style speakers mounted inside
      a. Shall be mounted to building structure.
      b. Aim the speakers to cover the most area.
   3. Speakers shall be mounted to provide maximum coverage of the area intended to be served.
   4. Provide a CAT-6 Patch cable for each speaker.

E. Speakers that are to be wall-mounted shall be mounted to a wall-mounted box.
   1. The speakers shall be mounted in a backbox that entirely covers the back of the speaker.

2. The backbox shall be mounted securely to wall over top of a single-gang backbox. It shall be mounted so that the sound is not impeded by obstructions between the speaker and the listener.
3. Provide a CAT-6 patch cable for connection of the speaker to the CAT-6 network cable. A coil of at least 2 feet of cable shall be left at each speaker so that they can be removed from the backbox without disconnecting the speaker.
4. If there is no backbox then fish the wall and install the patch cable to connect the speaker.

F. Set all custom messages on clock devices. Couple all message with buttons on the console and with time schedules for bells.

G. Custom create messages based on input from the owner.

H. Create buttons on the console/software for distribution of each custom message. Set start and finish times for messages.

I. Create custom colors for messages and strobes based on input from the access control system. Set time frames for strobes and messages.

J. Create button on console and in software to reset system to normal operation.

3.06 SYSTEM TESTING

A. The Contractor shall be responsible for all aspects of the sound of the system once installed.
1. The sound of the system is of utmost importance to the Owner. The Owner requires a system that is intelligible when the space is occupied or unoccupied.
2. Each room shall be tuned and the audio output level of each speaker shall be set to provide the best sound possible.
3. The Contractor shall go into each room and conduct a listening test to determine that the sound is intelligible and that the gain is not set too high. This shall be done in each room and each area.
4. In each classroom, test the talkback thru each speaker and the telephone system.
5. Test each configurable zone and ensure that audio comes thru the speakers and that they are only attached to each zone.
6. Prior to acceptance of the system, the Contractor shall conduct a system walk-thru with the Owner and the Engineer.
7. The walk-thru shall consist of entering each room, making a call from a telephone and making an announcement into that room through the paging system.
8. The Owner and Engineer will be checking for complete coverage in each room and correct volume setting of the speakers and the associated volume controls. Any changes required shall be the responsibility of the Contractor.

3.07 TRAINING

A. The Contractor shall furnish pre-acceptance and post-acceptance training on the paging/bell system.
1. The first training shall occur during the on-site system configuration. 1 or 2 Owner’s Representatives shall be present when the technician is setting up the system and doing the programming of all the extension numbers and different call groups.
2. Formal training shall be done with Owner’s Representatives after installation and configuration of the system. The training shall include:
a. Copies of all pertinent paperwork and system booklets that come with the paging/bell system.
b. A spreadsheet listing all the speaker groups and their corresponding rooms, extension numbers, and a drawing graphically representing the speaker groups.

c. The Contractor shall provide a short booklet detailing the steps required to perform all the general functions of the paging system. These functions shall include paging any and all rooms, groups and general areas, and any combination of areas.
d. The Contractor shall provide extensive training on the configuration software of the paging/bell system. This shall include the initial setup of the paging/bell groups and reconfiguration of groups. It shall also include training on how to sound emergency tones, play auxiliary inputs, restrict access, change user access numbers, and allow paging through the desktop microphone.
e. A complete overview of the capabilities of the control system and a demonstration of all activities including setting up a call group, changing extension numbers and associated names, and making changes to bell tone times and groups.
f. At the end of the training, the administrators shall be able to fully configure and control all aspects of the paging and bell systems.
g. All training shall take place on the Owner's site with the Owner's system.

END OF SECTION 28 1810

SECTION 28 3500 – PHYSICAL ACCESS CONTROL SYSTEM (PACS)

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. This section includes parts and equipment required for installation and termination of a building-wide Physical Access Control System (PACS). This system shall be referred to as the “security system”, “system” or PACS throughout these specifications.

1.02 SYSTEM DESCRIPTION

A. The security system shall be supplied and installed by a Contractor able to show examples of similar projects and installations within the last 3 years.

B. The security system shall serve the building but shall be able to be expanded to serve additional buildings in the future.

C. The Security System shall provide a solution for access control and alarm monitoring. This shall be through a central server with PC attached workstations for monitoring and control. Shall include:
   1. Access Control
   2. Alarm Monitoring
   3. Badging and user database/Photo imaging
   4. Video and Audio intercoms

D. Contractor shall provide all software required for connection of the security system to the in-house data network and associated control PC’s.

E. The security system client-server architecture shall communicate with native TCP/IP over an existing Ethernet TCP/IP enterprise network.

1.03 COORDINATION

A. All cables shall be coordinated with the door hardware and security devices being installed as part of this project.

B. PACS cable shall be a unique color from the Telecommunications cable, fire alarm cable and lighting control cable. Coordinate this with the Electrical Contractor prior to ordering the equipment and installation of the cables.

1.04 PROJECT PLAN

A. Prior to ordering equipment and installation, the contractor shall provide a project plan to the owner and contractor that describes the system and its capabilities and the possible configurations.

B. Provide a project approach which describes the installation and implementation plan and schedule and all sequencing.

C. Meet with the owner numerous times to determine how the system should work and how it should be monitored.
   1. Configure the system prior to installation to meet these requirements. Demonstrate the system use to the owner prior to installation and obtain approval to move forward with the installation.

D. Generate a testing plan and have that plan approved by the owner and engineer prior to installing the system.

E. The system shall be installed and tested prior to cutting over any doors to the system. Provide and install temporary card readers, door contacts etc to the system for testing. Demonstrate that this works prior to cutover.

F. Conduct all testing of the system

G. Conduct user training on the system

H. Provide as-built documentation of the installed system

1.05 RELATED STANDARDS

A. The security system shall conform to the following international and national standards:
   1. FCC Rules and Regulations
   2. UL 294 Access Control Systems
   3. UL 1076 Line Supervision
   4. 21 CFR part 11
   5. Part 15, Radio Frequency Devices
   6. National Electrical Manufacturers Association (NEMA.)

7. Applicable Federal, State and Local laws, regulations, codes
8. National Electrical Code (NEC)
9. NFPA 80 National Fire Protection Agency - Fire Doors & Windows (edition is jurisdiction dependent).
10. NFPA 101 National Fire Protection Agency - Life Safety Code (edition is jurisdiction dependent).
11. NFPA 105 National Fire Protection Agency - Smoke Control Door Assembly (edition is jurisdiction dependent)
12. ANSI 117.1 1992 Edition Providing Accessibility and Usability for Physically handicapped People.
13. A.D.A.A.G Americans with Disabilities Act Accessibility Guidelines.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Approved vendors for security cables are:
   1. General Cable.
   2. Belden.
   3. West Penn Wire and Cable.
   4. Equivalent manufacturers.

B. Approved manufacturer for panels and power supplies are:
   1. Altronix
   2. Life Safety

C. Approved vendor for Physical Access Control System (PACS) equipment is:
   1. Lenel S2 OnGuard
   2. The owner has an S2 system existing. Expand this to the new spaces or renovated spaces to support new door and access control systems.
   3. Expansion of the system shall utilize Mercury boards for all new panels.

D. As part of the bid the contractor shall explicitly detail the software package that is provided and shall provide a document showing all software available from the manufacturer.
   1. The document shall explicitly state which software is provided as part of the bid and shall detail other software available but not provided as part of the bid.
   2. We require this to be able to determine the level of software available and will allow us to fully review the system as a whole.

2.02 DESCRIPTION OF PROJECT

A. The owner has an existing Lenel S2 OnGuard system in place
B. Expand this system to support new end point devices.
C. Fully integrate the new panels and end point devices to the system.
D. See drawings for end points and devices to be connected.
E. The access control system shall be an all-encompassing system that is large enough to serve numerous employees and be extended to numerous buildings. The system shall, collect data and monitor doors and entrances at:
   1. No less than 10 Buildings
   2. Support no fewer than 2000 users
F. The original installation will be for the building(s) noted on the drawings. The system installed shall not preclude the extension of the system to other buildings.
G. The system shall include all equipment, software, cabling, data collection points, card readers and hardware to monitor and control the specified devices and provide reports to a security station as required by the owner.
H. If an Intrusion Detection system is specified, then the access control and intrusion detection system shall act as one system. They shall be integrated such that the presentation of a known access card will shunt all intrusion alarms for the door where the card was presented.
I. The system shall keep records of all access control card presentations.
J. The system shall connect to and interoperate with all the door hardware that which is existing and being added as part of this project.
K. The system shall be able to be connected to other buildings via the existing data network. Specify how the system will connect to other buildings as part of your bid response.

L. The Owner shall be able to change and monitor all settings for intrusion and access to all the buildings through the control PC.

2.03 MATERIALS

A. All security and control cables shall be plenum rated.
   1. Contractor shall provide all appropriate cable from the door security hardware to the security system. All cabling shall be plenum rated.
   2. Some locations require outdoor rated cabling. The contractor shall provide the cabling to match the required area.
   3. There will be requirements for many different types of cabling and the contractor shall provide for each.
   4. Provide a coil of cable at each location for moves and maintenance.

B. The system shall be fully configurable and compartmentalized so that any user can be assigned and they will only see the status of doors at one building.
   1. Based on a user's login, the system shall be configurable to restrict persons from seeing or controlling doors and lock schedules at building that they do not have permission to see or control.

2.04 SECURITY SYSTEM SERVER

A. Management Server:
   1. Server/Appliance for Lenel S2 OnGuard is existing
   2. Configure new devices and new users on the system.
   3. Contractor shall connect the Server to the Ethernet in the building.
   4. Provide all equipment required to mount the Server in the cabinet/rack
   5. Server shall connect to the Access Control Module via the Ethernet network

2.05 ACCESS CONTROL SYSTEM SOFTWARE

A. Software shall be Lenel S2 OnGuard

B. Provide, install and configure

2.06 SECURITY ENCLOSURE

A. Shall be provided to hold power supplies, controllers, access control panels, card reader panels, input/output cards (now to be referred to as security panels) and any other components required for a complete access control system.

B. Security enclosures are the physical boxes and cabinets that support the intelligent controllers, I/O boards, power supplies and power distribution equipment.

C. Security panels hall be wall mounted and large enough to hold power equipment and access control system controllers and cards.

D. Security panel shall be:
   1. UL: Listed: UL 294 approved
   2. Enclosure shall accommodate power supply and sub-assemblies such as controllers and security cards to be provided as part of the project.
   3. Primary power input shall be 115VAC
   4. Physical
      a. Size enclosure as required to hold power supplies and security panels. Provide multiple enclosures where required.
      b. Made of 16 AWG sheet metal
      c. Shall have conduit knockouts or custom cut holes for access to the panels for cabling.
      d. Be equipped with an internal cam lock
      e. Be equipped with a tamper switch that shall be wired to the I/O for software alarm when the panel is opened.
      f. Shall have space for batteries to support the access control system.
   5. Equip with a backplate that shall support direct mounting of the security panels and power devices
   6. Equip with magnetic cable supports that attach to the backplate to support cables.

E. Security Enclosure shall be Altronix Trove series or equal.

2.07 PLYWOOD TO BE MOUNTED BEHIND ALL SECURITY PANELS

A. Plywood shall be American Plywood Association (APA), Grade A-C at minimum. Meaning that the “A” side is smooth and paintable, neat repairs are permissible. “C” side allows knotholes to 1 inch and limited splits are permitted. “A” side is used for mounting; “C” side is installed towards the wall.
B. Plywood shall be 3/4-inch-thick and shall come in 4 foot x 8 foot sheets with a quantity of sheets installed as per the detailed drawings.
C. All plywood used for wallfields shall be fire-retardant plywood and shall be stamped as such.
    1. Shall have a Flame-spread rating of 25 or less,
D. Each piece of plywood with one coat of white paint. Paint all edges.
    1. Do not paint over one of the Fireproof stamps on the plywood. Leave this so that the owner can identify that the plywood installed is fire-retardant.

2.08 POWER SUPPLIES AND POWER DISTRIBUTION

A. Power supplies and power equipment shall be provided that support the entire access control system, security panels/controllers, door locks and all other field equipment of the access control system.
B. All power supplies shall be connected to 120VAC power with a hardwired connection. Install cable and connect to power.
    1. Provide and install conduit, wiring and connections required for 120-volt power connectivity.
C. Power supply shall be mounted to the enclosure. Shall include:
    1. Shall provide power to the panels in the enclosure and field devices.
    2. Shall include multiple 12 or 24 volt outputs. Shall be settable on the panel
    3. Input voltage of 120VAC with a fuse
    4. Classified as a Power-Limited stand-alone power supply with stand-by battery and suitable to power sensors and electro-mechanical devices (e.g. electric door strikes), as defined in the National Electrical Code/NFPA70/NFPA72
    5. Shall be sized for outputs of 1 thru 16 unique outputs.
    6. Battery connection for charging on-board batteries.
    7. Fire alarm disconnect
        a. Shall support Normally Open or Normally Closed trigger
        b. Shall be set to latching or non-latching
    8. LED indicators for:
        a. AC input
        b. DC output
        c. Battery discharged or no battery
    9. Over Voltage protection
    10. Short Circuit protection
    11. Power supply shall be Altronix #eFlow series or equal.
        a. Provide actual part that provides for all power and control of the system as required to meet the manufacturers requirements and these specifications.
    12. Equip with an Ethernet Module for panel control and monitoring:
        a. Shall support remote supervision, control and monitoring over an Ethernet connection.
        b. Connect to the owner’s network and setup monitoring.
        c. Altronix #Linq2 or equal
D. Access Power Controllers
    1. The Power Controller shall have the following characteristics:
        a. Powered by 12 VDC or 24 VDC from the power supply/charger board or via 8-Pin connector to stack with Voltage Regulator for dual voltage (12VDC & 24VDC) outputs from a single 24VDC input, up to 6 Amps
        b. Spade lug connectors to facilitate the transfer or sharing of 12VDC and/or 24VDC power between Access Power Controllers or Power Distribution Modules
        c. 8 trigger inputs to correspond with similarly numbered triggered controlled outputs, with each trigger input being in one of the following forms:

1) Normally open (NO) contact
2) Open collector

d. 8 independently trigger-controlled outputs with the following output options:
1) Fail-Safe filtered and electronically regulated power outputs
2) Fail-Secure filtered and electronically regulated power outputs
3) Form “C” relay outputs, rated 5 amps @ 28 VDC/VAC.
4) For each triggered output, LED indication of an active output.
5) Bi-colored LEDs for visual verification of voltage (12VDC or 24VDC) per output
6) An unswitched auxiliary power output, rated at 2.5 amps (fused) or 2 amps (PTC), used in lieu of a trigger-controlled output.
7) Fuse protected

e. FACP (Fire Alarm Control Panel) interface
1) input options from the FACP:
A) polarity reversal
B) Normally Open - Non-Latching or Latching with reset
C) Normally Closed - Non-Latching or Latching with reset
2) Ability for the FACP to trigger any of the trigger-controlled outputs
3) Trigger indications:
A) LED indicator on the module
B) Form “C” output relay contact rated 1 amp @ 24 VDC

f. Current protection
1) access control module: 10 amp fuse
2) individual outputs: 2.5-amp Class 2 rated PTC device

2. Access power controller shall be Altronix #ACMS8 or equal.

E. Power Distribution board with voltage regulator.
1. The Power Distribution Module shall be a UL Listed Sub-Assembly board level product comprised of fused protected outputs to furnish 12 VDC, 24 VDC or 24 VAC power to surveillance, security, access control systems and components, and other security-related equipment.
2. Power distribution module shall include:
a. The Power Distribution Module shall employ a single distribution board.
b. The Power Distribution Module shall output 5VDC to 24VDC up to 10A each or 16VAC to 28VAC up to 14A each.
c. Fused protected outputs.
d. Individual voltage LEDs indicate 12VDC (Green) or 24VDC (Red and Green)
3. Modules shall provide for:
a. Dual Power Supply Inputs.
b. Outputs shall be switch selectable as to route power via Input 1 or Input 2.
c. Shall be stacked with a voltage regulator and connected via eight (8) pin connector.
d. Individual voltage LEDs indicate 12VDC (Green) or 24VDC (Red and Green).
e. Eight (8) individually fused device protected outputs.
4. Power distribution board shall be Altronix #PDS8 or equal
a. Equip with a voltage regulator Altronix #VR6 or equal.

F. Battery Backup
1. The enclosure shall have battery backup UPS circuit with built-in battery charger that shall provide automatic battery backup UPS power in event of AC line failure.
2. Each controller enclosure panel shall have a battery for power failure. Battery shall be fully enclosed in a metal cabinet.
3. The battery shall provide for full UPS operation for a minimum of 30 minutes
4. Batteries shall not be mounted in the enclosure where they would cover a control or door panel in the enclosure.
5. Provide larger enclosure or secondary enclosure for batteries.

6. Where a battery only enclosure is provided, label this enclosure with a label that says “ACCESS CONTROL PANEL BATTERIES”

2.09 ACCESS CONTROL MODULE/CONTROLLER

A. The Contractor shall provide intelligent controller modules / cards for the security system that utilize a true distributed processing technology with local processing at each controller.
   1. Shall provide for an open architecture.

B. One module per communications room or immediate adjacent enclosures shall provide for communications with the server/software via on-board 10BaseT/100BaseTX Ethernet port and support TLS encryption as a minimum security implementation.

C. In the event system communications is lost or the server/cloud fails, all networked intelligent controller, (controllers or security panels or modules, terms will be used interchangeably) shall provide complete control, operation, and supervision of all monitoring and control points based on the latest database information.

D. The controller shall provide centralized biometric template management and support a wide range of reader technologies, including OSDP, Wiegand, magnetic stripe and biometric.
   1. Control module shall support, as a minimum the following open standards:
      a. PSIA Area Control,
      b. SNMPv3/v2c,
      c. OSDP and OSDP SC.
   2. The controller shall utilize a cryptographic module, like OpenSSL FIPS Object Module RE, that is validated to FIPS 140-2 thus providing a certified implementation of Transport Layer Security.
   3. Security on the controller shall include:
      a. Host/Controller connection protected by TLS 1.2/1.1 or AES-256/128
      b. Controller/IO Expansion connection protected by AES
      c. Generate and load custom peer certificates for TLS
      d. Port based network access control using 802.1X
      e. Crypto memory chip
      f. FIPS 140-2 user of OpenSSL
      g. HTTPS protection for installer web pages
      h. Secure cookies
      i. SNMPv3/v2c
      j. DIP switch toggle sets 5-minute time to disable webpage access
      k. Disable default login credentials
      l. Authorized IP address filtering
      m. IP Client Proxy
      n. Bulk erase controller and periphery devices during replacement
      o. Strong password enforcement
   4. Door Control on controller shall support:
   5. One or two-reader ports: Clock and Data, Wiegand, or RS-485
      a. Eight programmable inputs, four relays, diagnostic LEDs
   6. Access Control shall support:
      a. 240,000 Cardholder capacity
      b. 50,000 Transaction buffers
      c. If/Then Macro capability
      d. Adjustable cardholder capacity
      e. Supports up to 520 inputs and 516 outputs
   7. Card Formats supported shall include:
      a. 16 card formats per active reader, 8 per offline reader
      b. Entire card number reported on invalid read
      c. 19-digit (64-bit) User ID and 15-digit PIN numbers maximum
      d. PIV, CAC, TWIC card compatible
      e. 255 Access Levels per card holder
      f. Activation/Deactivation Date or Date & Times
   8. Card Reader Functions shall include:

a. Multiple card format support by reader
b. Paired reader support
c. Alternate reader support
d. Elevator support
e. Turnstile support
f. Biometric device support
g. Open Supervised Device Protocol (OSDP) and OSDP SC compliant
h. Occupancy count
i. Support of multi-occupancy rules
j. Anti-pass back support
k. Area-based, reader-based, or time based
l. Nested area, hard, soft, or timed forgiveness
m. Supports host-based approval rules
n. Keypad support with programmable user commands, card input
o. Shunt relay support
p. Strike follower relay support
q. Threat level and Operating Modes
r. Host controlled OSDP reader passthrough
s. Elevator floor override

E. The controller shall be configured to avoid system failure. In the event of a server or system failure, transactions are to be stored at the controller until the server and connection is back online. Once it is online then the information shall be downloaded to the server.
1. The controller shall be utilized as the “brains” of the security and access system. All door contacts, card readers, request to exit contacts, assisted openers, door controllers, electric latch devices, electric strikes and other devices shall connect to the controller.
a. Controllers shall be microprocessor-based, multi-tasking, multi-user, and use real-time, digital control processors.
b. Each control panel shall consist of modular hardware including power supply, CPU board, and various input/output modules.
c. Memory at the controller shall be large enough to store 10,000 card holder information points.
d. Controllers shall be able to be updated via remote connectivity or direct connectivity. Updates shall be for new firmware or software updates.
2. Controller shall be fully configurable by the Owner via a Microsoft Windows type interface through the operator workstation or through offsite connectivity through the IP network.
3. Controllers shall mount in enclosure on the wall where noted on the drawings.
4. Provide the quantity of controllers required for all electronic door locks, card readers and all other devices noted on the drawings and specifications.
a. Each controller shall have onboard LED’s for self-diagnosis.
5. Each controller shall support IP communications. Additional communications shall be via RS-232 and or RS-485.
6. Shall include a real-time on-board clock synchronized with Server.
7. Where the door hardware installer provides a door interface or door controller card that works with the electric latch/strike and request to exit button, the communications contractor shall provide the correct interface to read data and send data to the door controller.
8. The link to other systems shall take place at the controller as well as through the I/O boards so that in the event of failure or an alarm. the rest of the system shall continue to function correctly.
9. The maximum time for door opening from the proper presentation of a card shall be less than one second.
10. ADA assisted Openers
a. Controller shall interface with ADA openers and ADA door buttons.

b. At some doors, there are assisted openers. At these doors, the controller shall completely work with the opener. Include equipment, cabling, connections and programming to allow the doors to function as per below:
1) When approaching from the exterior and doors are locked:
A) Present a card and then door shall be unlocked. Push the auto opener and the door shall open.
2) When approaching from the exterior and doors are unlocked:
A) Push the auto opener button and the door opens.
3) When approaching from the interior and doors are locked:
A) Push the auto opener button and the door shall unlock and open.
4) When approaching from the interior and doors are unlocked:
A) Push the button and the door opens.

11. Controller shall connect to the fire alarm system. In an alarm condition, the controller shall unlock doors as required to allow people to enter and exit the building. The Contractor shall provide all cabling, software and hardware required to interface with the fire alarm system as well as the video security system.
12. Controller with Ethernet connectivity shall be Mercury LP Series or equal
13. Controller with RS-485 connectivity shall be Mercury MR Series or equal

F. I/O Cards/Modules shall be installed in the enclosures and attached to the controller to allow input and output to the field devices throughout the building(s).
1. Provide additional modules or boards to support all control, access and security points shown on the drawings and described in the specifications.
a. I/O boards shall pop in and pop out. Replacing a board for a certain point shall not require shutting the entire controller down.
2. Modules shall be installed to connect to the field devices, including but not limited to:
a. Door contacts,
b. Request to exit devices,
c. Push buttons/Panic buttons
d. Toggle Switches
e. Assisted door opener devices and door opener buttons
f. Motion sensors.
g. Strobe lights
h. Embarrassment alarms / exit alarms
i. Lockdown buttons with Lockdown Status Light
j. Other field devices noted
k. All other security devices required and shown on the drawings.
3. Modules shall translate information from the field devices to the controller and thus the server for records and access control.
4. I/O Card shall be provided that serve access control devices such as door contacts and garage contacts. These cards shall provide alarms when the contact is “open”. The time before alarm shall be fully configurable by the owner.
5. Output types shall be digital/analog for control of doors. In addition to the door output, the control module shall contain auxiliary outputs for ON/OFF control of other devices.
6. Shall provide inputs and outputs to monitor and control non-reader-based system points, such as door contacts, motion sensors, gate actuators, ADA Buttons and ADA openers etc.

2.10 CREDENTIALS

A. ID Cards/Keyring Fobs:
1. All Credentials for users are existing.

2.11 DOOR LOCKING DEVICES

A. Latch Retraction device: “LR” on drawings
1. The door hardware installer will install a Latch Retraction device as shown on the drawings.

2. Provide and install a power supply in the communications room to power the LR device. Review the door hardware and match the power supply to the Latching Retraction devices. Provide quantity as required to power all LR devices
3. The security contractor shall wire from the LR device to a power supply in the communications room and then to the controller panel in the communications room.
4. Provide cards in the controller panel and equipment to allow the security system to interface with the LR.
5. The LR shall be able to be held open based upon a time schedule put forth in the security system. It shall also be able to be retracted upon presentation of a valid card or fob to the card reader.
6. See door hardware specifications for transfer hinge and wiring harness provision plans.
    a. If wiring harness is provided as part of door hardware:
        1) Wire from door harness, through raceway and back to the power supply in the comm room. Wire to security panel for control of the door.
        2) Provide custom wiring and connectors to connect to the wiring harness
    b. If no wiring harness is provided as part of the door hardware.
        1) Wire from the LR, through the hinge and back to the Power Supply in the comm room. Wire to security panel for control of the door.
    c. Provide manufacturers recommended cabling type and wire gauge.

B. Electric Strike. “ES” on drawings
1. The door hardware contractor shall install the Electric Strikes.
2. The contractor shall wire from the ES to the security panel. Provide cabling to control the ES and power the ES.
3. Provide power supply in the comm room to power the ES.

2.12 READER DEVICES

A. Card Readers: “CR” on drawings
1. Refer to the drawings for locations where card readers “CR” are required.
2. Card readers shall be combo readers that read standard 125 khz readers for standard prox and 13.56 MHz “smart” cards and 2.4Ghz (Bluetooth) compatibility.
3. Card readers shall be completely compatible with the security/access system.
4. Card readers shall be mountable in a single gang box or in the frame of a door. Refer to drawings for locations.
5. Readers shall be sealed to allow outdoor installation.
6. Power requirements for the card shall be between 12 volts DC.
7. Reader must be capable of providing a read range up to 2” for proximity/Smart cards without modification.
8. Mobile credential range shall be 3”. In Tap mode. Tap mode is a setting on the card reader.
9. Reader shall operate in a temperature range of minus -31°F to 150°F.
10. Reader shall be designed for both surface mounting and mounting on a single-gang electrical box.
11. Reader shall have a tri-color light emitting diode (LED. and audible tone for noting of accepted read or rejected card read.
12. Reader shall flash the LED green momentarily and emit a short beep to indicate that a card was read.
13. Shall communicate via Wiegand and or OSDB (Secure RS-485)
14. Card readers on single-gang boxes shall be HID Signo #40NKS—00-000000 or equal.
15. Card readers on the frame of a door shall be HID Signo #20NKS—00-000000 or equal.
16. Keypad Reader.”KR: on drawings
    a. Card readers with numeric keypad, on a single-gang backbox shall be HID Signo #40KNKS-00-000000 or equal
    b. Card readers with numeric keypad, on mullion shall be HID Signo #20KNKS-00-000000 or equal

2.13 DEVICES AT THE DOOR

A. Door Contacts; “DC” on drawings. Single Pole, Double Throw, Form C
   1. Contractor shall install magnetic door contacts in the top of each door required to be monitored. See drawings for door contact “DC” locations.
   2. Install industry standard magnetic door contacts into the top of the door and the matching contact into the header of the door.
   3. Contacts shall be compatible with the security/access system and intrusion detection system. Each contact point shall be defined in the software and shall be given an alphanumeric designation.
   4. Contacts shall connect back to the controller **and** intrusion detections system.
      a. Connect cable to the PACS System as an input.
   5. In locations where there are double doors, two contacts shall be installed and the connections shall be made so that the opening of each door is detected.
   6. When the contact is installed in the recessed part of a metal doorframe, an appropriate, solidly attached metal support shall be used. The tolerance “gap” shall be adjusted to the frame and the door.
   7. Wire door contacts back directly to an I/O card in the controller panel. DC’s shall not be wired through Request to Exit devices.
   8. Door contacts shall be 1” diameter.
   9. Door Contacts shall be George Risk Industries, GRI #194-12 or equal



   10.

B. Garage Contacts “GC on drawings, Single-pole, Double-throw
   1. Garage contacts shall be used for roll up garage doors.
   2. Install the contact on the wall or on a custom bracket along the side of the door. They are not to be mounted on the floor.
   3. Create a custom bracket to mount the contact.
   4. Mount other magnet on the door. Create a custom mount if required.
   5. Contacts shall connect back to the controller **and** intrusion detections system.
      a. Connect cable to the PACS System as an input.
   6. Garage Contact shall be Honeywell #958-2 or equal.



   7.

C. Motion request to Exit Connections: “MX” on drawings
1. On doors marked with a “MX” the Contractor shall install and connect a motion based request to exit switch that is mounted above the door.
2. Refer to the doors on the drawings with “MX.”
3. Contractor shall connect all “MX” doors to the security/access system to shunt the alarm when a person engages the MX switch at the door. This shall allow persons to leave the building without triggering the alarm even when the doors are locked and armed.
4. Contractor shall provide all cabling and programming required for all request to exit connections. These cables shall be directly back to the controller panel and shall not be tied directly to door contacts
5. Each “MX” shall include a configurable sensor pattern and shall have a LED indicator light.
6. MX shall be Honeywell #IS310 or equal.
7. 

D. Hard-wired Request to Exit devices “RX” on drawings
1. These devices are located in the latch retraction devices or electric lock devices.
2. These devices are provided and installed by the door hardware contractor.
3. Security contractor shall wire from the RX to the I/O panel in the network controller.

E. Embarrassment Alarm Bell/Buzzer: “EA” on drawings.
1. The communications contractor shall install an alar/bell where noted on the drawings.
2. The alarm bell shall provide a noise when an action occurs and is triggered from the access control system
3. When the system is armed and a door contact is opened the alarm / bell shall sound, alerting the person who opened the door that the system is in an alarm mode.
4. This shall be set for a timed duration of no more than 30 seconds. Configure the system to support this duration.
   a. Shall be set at 85 dB
   b. Shall work with power between 6VCD and 28VDC
5. Shall be on a single-gang, stainless-steel faceplate.
6. Alarm shall be Alarm Controls #TS-41 or equal
7. 

F. Release Button “RB” on drawings
1. Release Button shall be a button to push prior to entering or exiting a door.
2. This button shall be attached to the security panel and through discussion with the owner, determine and configure what this button shall trigger.
3. Wire from this device to the security system to inform the system to the status of a button

4. Configure so that in a lockdown the door button will be shunted and will not unlock the door.
5. Button shall be Alarm Controls #TS-9 or equal when installed on a doorframe. Mount on a backbox, SMB-3
6. Button shall be Alarm Controls #TS-5T or equal when installed on a wall
7. Provide custom lettering on the button that says “XXXXX” confirm with designer prior to ordering.
8. 

or 

2.14 AUTO OPERATOR DOOR INTERFACES

A. Assisted Opener “AO” on drawings
   1. The contractor shall wire to the assisted door openers where shown on the drawings.
   2. The wiring shall allow integration of the working of the door locks, card readers and the push to open buttons.
   3. The work shall include wiring and integration at the doors and at the controller panel to allow the Assisted Openers to work as required by the owner. See specs and drawings for additional information.
   4. Connect cabling to the security panel and the assisted opener and assisted opener buttons to complete system connectivity and configuration.

B. Assisted Opener Buttons. “AB” on drawings
   1. Assisted opener button is provided by others.
   2. Wire from the “AB” devices inside the vestibule and inside the building to unlock the door and then trigger the door to open when exiting the building.
   3. Provide all cabling to connect the AB devices to the access control system.
   4. Configure the security system to unlock doors as people exit the building and push the opener buttons to exit.

2.15 FIELD DEVICES

A. Security Contacts/Contact Closures: “CC” or “SC”
   1. Contractor shall provide an interface in the controller for connections to dry contact closures of other systems.
   2. Dry contact shall cause an alarm on open or closed state depending on Owner required configuration of the controller.
   3. Contractor shall provide all cabling and configuration required interfacing the security/access system with all security contacts.
   4. Contacts shall be provided as per the drawings and shall interface with the other systems as shown.

2.16 DEVICES AT THE OPERATOR DESK

A. Pushbutton Release: “PB” on drawings
   1. The drawings show a “PB” where required. This shall function to facilitate the immediate or direct deactivation of an electro-magnetic lock or electric latch or electric strike or other programmed series of events when depressed.
   2. The push button shall allow the temporary deactivation of the supervisory systems of a controlled door to permit access without generating an alarm (authorized access.

3. Push buttons shall be below the desk or as noted by the owner.
4. Wire back to the IO panel in the networked controller
5. PB shall be Alarm Controls #TS-18 or Schlage 660 series or equal.
6. 

or 

B. Toggle Switch; “TS” on drawings
1. The drawings show a “TS” where required. This shall function to facilitate the immediate locking of one or more doors that are controlled doors in the building.
2. The button shall also be able to trigger other output devices as determined by the owner during design meetings.
3. The button shall have a dual purpose. When flipped, the switch shall lock a door and when flipped back shall unlock the door.
4. The toggle Switch when switched shall allow multiple outputs such as unlocking of doors, pages, telephone calls to security personnel, audible alarms etc. All this shall be configurable in the security system.
5. The toggle switch shall be a button mounted to the underside of a desk and shall be equipped with a cover for safety.
6. Toggle Switch shall be Allegion #660 T4 or equal.
7. 

C. Lockdown Button; “LD” on drawings
1. The drawings show a “LD” where required. This shall function to facilitate the immediate locking of all electronically controlled doors in the building.
2. The button shall also be able to start the piezo and beacon strobe light for a set duration of time (if system is so equipped). This duration shall be able to be set by the owner.
3. The button shall have a dual purpose. When pressed, the switch shall put the building into a lockdown situation. When pulled (or pushed again) out the building shall revert to its schedule locking status.

4. The lockdown button when switched shall allow multiple outputs such as
   a. Locking/ unlocking of doors
   b. Engaging light on faceplate to note that the system is in lockdown
   c. Engage any beacon strobes or Piezo screamers if shown on floorplans.
   d. Initiate pre-recorded messages via the paging system (if shown on floorplans)
   e. Set levels for access thru card readers. Some users may not be able to use their cards to enter the building during a lockdown.
   f. All this shall be configurable in the security system.
      1) Work with the owner and determine what steps are to occur when the lockdown button is pushed. Configure the system to meet those need.
5. The lockdown button shall be mounted in a standard single-gang backbox and shall be equipped with a cover for safety.
6. Include a status light on the illuminated button
   a. The light shall be a red light that is on only when the system is in lockdown.
   b. When the system is taken out of lockdown the light shall turn off.
7. Faceplate shall be custom screen printed to say “LOCKDOWN”
8. Lockdown Button shall be Safety Technology International #SS2429LD-EN or equal.
   a. Provide all cables required to connect this button and power the light
   b.



2.17 INTERCOM –IP BASED

A. Intercom (Audio/Video) at doors; “IC“ on drawings
   1. At locations shown on the drawings, the Contractor shall install audio/video (IC) Intercom devices to allow visitors to contact the office to announce themselves and to gain entry into the building.
      a. Connectivity of the components shall be via manufacturer CAT-6 cables to the data network. This shall be from the exterior interfaces, throughout the system and to the Ethernet network inside the building.
      b. Shall connect to standard SIP devices for audio and video connectivity.
      c. Shall interface with standard video security software to allow recording of camera on each intercom.
      d. Power and data shall be via the Ethernet network and CAT-6 cabling.
   2. Audio/video intercoms “IC” at the door shall have the following characteristics:
      a. Device shall have a single, 1-touch, push-button for calling into the interior base station. This shall open a 2-way communications path between devices.
      b. Shall have a color camera inside the intercom that is viewable at the interior base station.

c. Include the backbox for custom mounting. Provide weather proof equipment outdoors.

3. Outdoor intercom, Surface mounted audio/video intercom, IP based,
   a. Surface mounted Stainless Steel intercom shall be Aiphone #IX-DVF or equal.
      1) Equip with Surface box, Aiphone #SBX-IDVF
   b. Door Frame mounted intercom to fit on the door frame shall be Aiphone #IX-DVM or equal.

B. Base Station (BS) There shall be an audio/video intercom station at the noted offices.
   1. The audio/video intercom shall be connected to the IP network and logically attached to all intercoms at the doors.
   2. The audio portion of the station shall have a volume control.
   3. The video portion of the station shall control camera view.
   4. There shall be a door release button that interfaces with the access control system and unlocks the door that is calling.
   5. Shall include:
      a. SIP 2.0 Compliant allowing integration with Cisco Unified Call Manager®.
      b. ONVIF® Profile S Compliant
      c. 802.3af PoE, Class 0
      d. 7″ TFT LCD touchscreen
      e. Hands-free or push-to-talk communication
      f. 8 customizable speed dial buttons
      g. 2 contact outputs, 4 trigger inputs
      h. 8Ω 1/2 watt speaker output provides better coverage for announcements
      i. 600Ω audio input.
   6. The interior audio/video intercom shall be Aiphone #IX-MV7-HW-JP or equal

C. IP Adapter for control of doors
   1. Provide an adapter in the comm room near the access control panel to interface between the intercom system and the intercom
   2. Provide a 4 contact inputs and 10 relay outputs. Provide quantity required for control of all doors equipped with an intercom (IC)
   3. Relay adapter shall be Aiphone #IXW-MAA Programmable Relay Adaptor:
      a. This shall contain no less than 4 Contact Closure Inputs and 10 Contact closure outputs.

D. Cabling for the audio/video interfaces at the doors and other components shall be plenum rated.
   1. Provide the type and quantity of cables required for connectivity. Review manufacturer’s requirements and provide adequate cabling.
   2. Install a wrap-around cable at each termination point of the interconnection cables. The label shall detail which device the cable connects to.
   3. Install cabling to allow the office device to release the lock on the door where the exterior intercom is located.
   4. Install cabling and configure the system to support integration between the intercom and the push button that is installed at ADA height.

E. Pass Thru’s
   1. Where no pass-thru is provided by others the contractor shall install conduit or UL listed wall pass thru’s sized as required to route all cables through all walls.
   2. Pass thru’s shall be EMT conduit or another UL listed rated device.
   3. Install thru all drywall, block, concrete walls and through any floors required to be penetrated
   4. Conduit shall be supported mechanically from the wall or floor structure. After installation, the raceway shall be firestopped to meet the requirements of the wall or floor.

2.18 WIRES AND CABLES

A. The contractor shall be responsible for supplying and installing all cabling to make the system operational.

1. Size conductors as required to transmit all power and signal to all devices.
2. All cabling shall be Plenum rated
3. All cabling shall be installed in raceways and in accessible ceiling spaces through cable supports.
4. Provide manufacturer specified cabling based on use and length of signal transmission from panel to device.
5. Generate drawings showing the cables required and get those reviewed by the designer prior to installation.
6. All cabling shall be labeled at each end with laser printed wrap-around labels

B. Plenum type, multi-conductor “Banana-Peel” type cabling shall be used where a Card Reader and door contact and electronic lock are utilized on one door or close two-door group.
1. Overall cable shall contain numerous other sub-cables within. Those shall minimally include:

Element Description	Element	Number of Element	Size	Stranding	Material
Card Reader	Pair(s)	3	18 AWG	7x26	BC - Bare Copper
Door Contact	Conductor(s)	2	18 AWG	7x26	BC - Bare Copper
REX/Spare	Conductor(s)	4	18 AWG	7x26	BC - Bare Copper
Lock Power	Conductor(s)	4	16 AWG	19x29	BC - Bare Copper

2. Inner Jacket

Element Description	Color
Card Reader	Orange
Door Contact	White
REX/Spare	Blue
Lock Power	Gray

3. All jackets and portions of the cable shall be Plenum Rated.
4. Cable shall be Belden #638AFS or equal

C. Install individual cables where required or where individual devices are to be installed. Identify cable type required by the device and provide and install the appropriate cable.
1. Install Plenum rated cable in all plenum rated areas.
2. Plenum-Type, RS-232 Cable: Paired, 2 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. Pairs are cabled on common axis with No. 24 AWG, stranded (7x32) tinned copper drain wire.
   a. NFPA 70, Type CMP.
   b. Flame Resistance: NFPA 262 Flame Test.
3. Plenum Rated, PVC-Jacketed, RS-485 Cable: Paired, 2 pairs, twisted, No. 22 AWG, stranded (7x30) tinned copper conductors, PVC insulation, unshielded, PVC jacket, and NFPA 70, Type CMG.
4. Plenum-Type, RS-485 Cable: Paired, 2 pairs, No. 22 AWG, stranded (7x30) tinned copper conductors, fluorinated-ethylene-propylene insulation, unshielded, and fluorinated-ethylene-propylene jacket.
   a. NFPA 70, Type CMP.
   b. Flame Resistance: NFPA 262 Flame Test.
5. Multi-conductor, Readers and Wiegand Keypads Cables: No. 22 AWG, paired and twisted multiple conductors, stranded (7x30) tinned copper conductors, semirigid PVC insulation, overall aluminum foil-polyester tape shield with 100 percent shield coverage, plus tinned copper braid shield with 65 percent shield coverage, and PVC jacket.

a. NFPA 70, Type CMG.
b. Flame Resistance: UL 1581 Vertical Tray.
c. For TIA/EIA-RS-232 applications.

6. Paired Readers and Wiegand Keypads Cables: Paired, 3 pairs, twisted, No. 22 AWG, stranded (7x30) tinned copper conductors, polypropylene insulation, individual aluminum foil-polyester tape shielded pairs each with No. 22 AWG, stranded tinned copper drain wire, 100 percent shield coverage, and PVC jacket.
   a. NFPA 70, Type CM.
   b. Flame Resistance: UL 1581 Vertical Tray.
7. Paired Readers and Wiegand Keypads Cable: Paired, 3 pairs, twisted, No. 20 AWG, stranded (7x28) tinned copper conductors, polyethylene (polyolefin) insulation, individual aluminum foil-polyester tape shielded pairs each with No. 22 AWG, stranded (19x34) tinned copper drain wire, 100 percent shield coverage, and PVC jacket.
   a. NFPA 70, Type CM.
   b. Flame Resistance: UL 1581 Vertical Tray.
8. Plenum-Type, Paired, Readers and Wiegand Keypads Cable: Paired, 3 pairs, No. 22 AWG, stranded (7x30) tinned copper conductors, plastic insulation, individual aluminum foil-polypropylene tape shielded pairs each with No. 22 AWG, stranded tinned copper drain wire, 100 percent shield coverage, and fluorinated-ethylene-propylene jacket.
   a. NFPA 70, Type CMP.
   b. Flame Resistance: NFPA 262 Flame Test.
9. Plenum-Type, Multiconductor, Readers and Keypads Cable: 6 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.
   a. NFPA 70, Type CMP.
   b. Flame Resistance: NFPA 262 Flame Test.
10. Paired Lock Cable: 1 pair, twisted, No. 16 AWG, stranded (19x29) tinned copper conductors, PVC insulation, unshielded, and PVC jacket.
    a. NFPA 70, Type CMG.
    b. Flame Resistance: UL 1581 Vertical Tray.
11. Plenum-Type, Paired Lock Cable: 1 pair, twisted, No. 16 AWG, stranded (19x29) tinned copper conductors, PVC insulation, unshielded, and PVC jacket.
    a. NFPA 70, Type CMP.
    b. Flame Resistance: NFPA 262 Flame Test.
12. Paired Lock Cable: 1 pair, twisted, No. 18 AWG, stranded (19x30) tinned copper conductors, PVC insulation, unshielded, and PVC jacket.
    a. NFPA 70, Type CMG.
    b. Flame Resistance: UL 1581 Vertical Tray.
13. Plenum-Type, Paired Lock Cable: 1 pair, twisted, No. 18 AWG, stranded (19x30) tinned copper conductors, fluorinated-ethylene-propylene insulation, unshielded, and plastic jacket.
    a. NFPA 70, Type CMP.
    b. Flame Resistance: NFPA 262 Flame Test.
14. Paired Input Cable: 1 pair, twisted, No. 22 AWG, stranded (7x30) tinned copper conductors, polypropylene insulation, overall aluminum foil-polyester tape shield with No. 22 AWG, stranded (7x30) tinned copper drain wire, 100 percent shield coverage, and PVC jacket.
    a. NFPA 70, Type CMR.
    b. Flame Resistance: UL 1666 Riser Flame Test.
15. Plenum-Type, Paired Input Cable: 1 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.
a. NFPA 70, Type CMP.
b. Flame Resistance: NFPA 262 Flame Test.

16. Paired AC Transformer Cable: 1 pair, twisted, No. 18 AWG, stranded (7x26) tinned copper conductors, PVC insulation, unshielded, and PVC jacket.
a. NFPA 70, Type CMG.
17. Plenum-Type, Paired AC Transformer Cable: 1 pair, twisted, No. 18 AWG, stranded (19x30) tinned copper conductors, fluorinated-ethylene-propylene insulation, unshielded, and plastic jacket.
a. NFPA 70, Type CMP.
b. Flame Resistance: NFPA 262 Flame Test.
18. Elevator Travel Cable: Steel center core, with shielded, twisted pairs, No. 20 AWG conductor size.
a. Steel Center Core Support: Preformed, flexible, low-torsion, zinc-coated, steel wire rope; insulated with 60 deg C flame-resistant PVC and covered with a nylon or cotton braid.
Shielded Pairs: Insulated copper conductors; color-coded, insulated with 60 deg C flame-resistant PVC; each pair shielded with bare copper braid for 85 percent coverage.
1) Jute Filler: Electrical grade, dry.
2) Binder: Helically wound synthetic fiber.
3) Braid: Rayon or cotton braid applied with 95 percent coverage.
4) Jacket: 60 deg C PVC specifically compounded for flexibility and abrasion resistance. UL VW-1 and CSA FT1 flame rated.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine all pathways prior to installation of all cables and raceways.

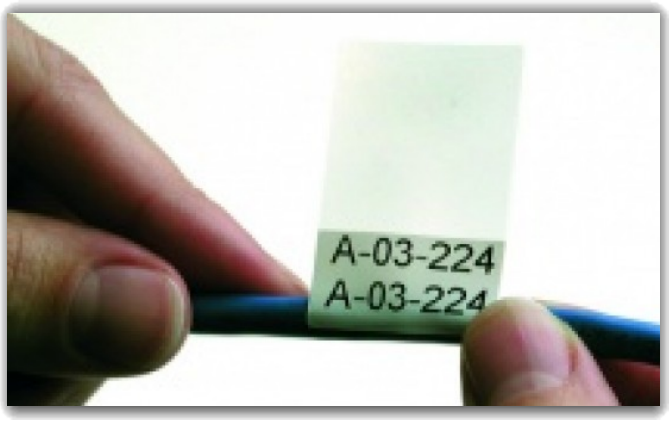
3.02 PREPARATION

A. Locate main path for all cables and install J-hooks where cable tray is not provided.
B. Coordinate with other trades to install a clear, straight path down major corridors for the routing of security/access cables back to the communications closet.
C. Plan installation of cables along wallfield in communications room. Provide finger-duct and D-rings for support of cables. See drawings

3.03 INSTALLATION-GENERAL

A. Security/access cable shall be installed per industry standards.
1. Install all cabling required for complete system connectivity. Cabling shall be plenum rated.
2. Care shall be taken to avoid crimping or bending the cable past the manufacturer’s recommended bend radius.
3. During installation, the cables shall not be pulled across the ceiling tiles or the structure of the building. This may cause damage to the cable jacket.
4. Adhere to all pulling tensions and bend radii during installation.
5. All cables shall route neatly in the ceiling. Whether they route in cable tray or J-hooks, the cables shall be neat and orderly.
6. Support cables at a minimum of every 5 feet.
7. When routing security/access cables parallel to electrical conduits and lighting ballasts, the cable shall maintain a clearance of at least 12 inches. When running perpendicular to electrical conduits and lighting ballasts the cable shall maintain 6 inches of clearance.
8. Provide a short coil of extra cable where the cable enters the vertical conduit. The coil shall consist of no less than 1-1/2 feet.
9. When installing cables in the communications room, all cable shall route neatly through the cable tray and cable ladder.
10. Provide a service loop of the cables on the wallfield.

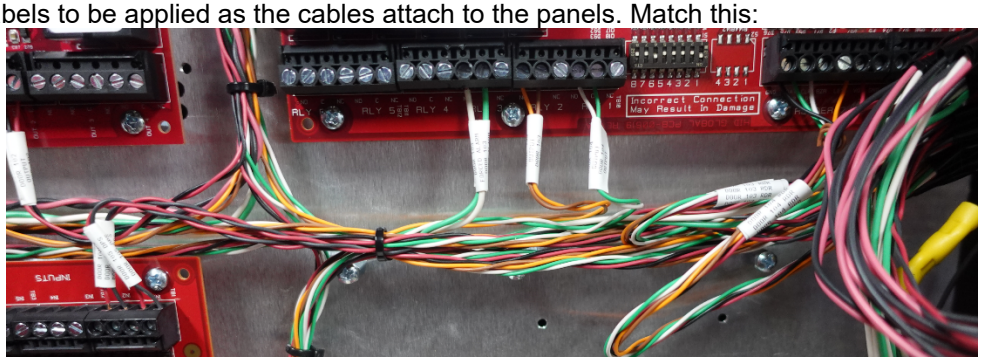
11. Each cable shall have a self adhesive, self laminating, laser printed label at each end. The label shall show the location identifier of that cable. Labels shall be installed no more than 4 inches from the termination point of the cable.



12.
13. Door labels on exterior of panel. Match this.

a. 

14. See labels to be applied as the cables attach to the panels. Match this:

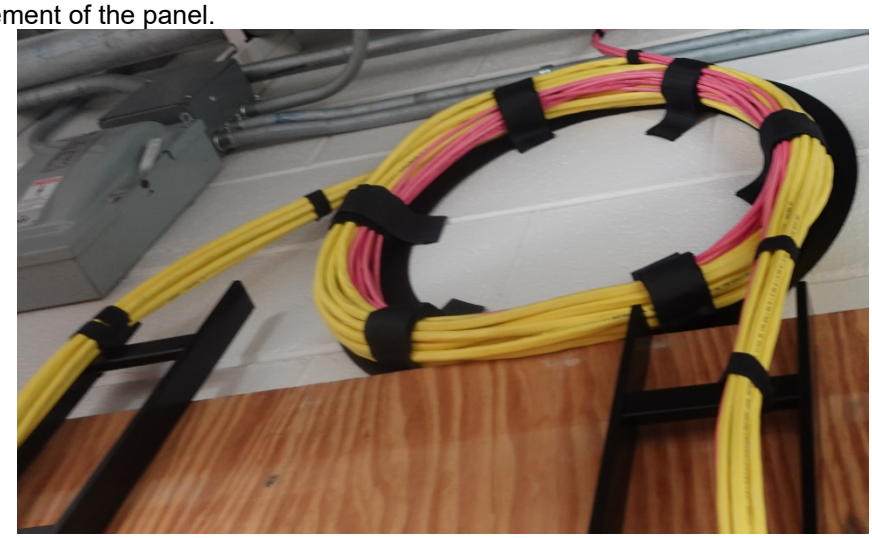
a. 

B. Firestopping is required at all riser conduits, and all pass thru's.
   1. Each cable tray penetration of a wall shall be firestopped after cable installation. Use pillow type firestop to allow additional cables to be installed in the future.
   2. Where riser conduits pass through floors, the area between the concrete and the conduit shall be firestopped. This shall be completed with a putty or liquid firestop product. Fill in the space with mineral wool, and then install the firestop on top. All firestop shall be of sufficient thickness to secure the rating required by code.
   3. After final cable installation, install a putty firestop around all cables where they enter and exit conduit pass thru's and conduit risers.

4. Firestop as per AHJ requirements.

C. Cabling at the Panel.

1. Contractor shall coil all spare cable from the door devices outside the security panel and shall neatly coil the cable on the wall. Provide 5’ minimum in the coil for future movement of the panel.

a. 

2. Cables shall route into the panels through a grommeted hole that is sized for the cables entering.
3. All cables shall be installed in a neat and workmanlike manner.
4. Cables shall be terminated and shall allow for removal of a card without un-terminating the cables.
5. All cables shall be neatly distributed to the card in the panel.
6. All labels shall be visible inside the panel near the termination point. Label cables equidistant from their termination point.
    a. Typical routing and cable organization in an access control panel.
    b. Route all cables along a central path.
    c. Label the cables as they entre the panel for the door to which they connect.
    d. Support cables along the backplate
    e. Label all interconnection cables with wrap-around labels that detail what they connect to.
7. Typical Trove Style panel

a. 

D. Proper support of cables is of paramount importance when installing a cable infrastructure. All cables not in conduit or cable tray shall be supported via J-hooks a minimum of every 5 feet.
   1. Routes of cables shall be parallel or perpendicular to the walls of the building.
   2. Install the J-hooks to minimize changes in the level of the cables as they route through the J-hooks.
   3. All communications shall route as high in the ceiling as possible while still being accessible and staying away from other utilities.
   4. When installing the cable through the J-hooks, they shall all have relatively the same droop between hooks. All cables shall be installed neatly and squarely.
   5. Secure the J-hooks to the building structure with beam clamps and threaded rod as required to support the cables.
   6. J-hooks shall never be attached to drop ceiling support wires. Cables shall never be supported by drop ceiling wires.

3.04 CONTROL PANEL INSTALLATION

A. Enclosure and power
   1. Contractor shall mount the enclosure on top of ¾” fireproof plywood.
   2. Mount enclosure in the location noted. Coordinate other equipment and wallfield systems.
   3. Locate the 120 volt power outlet and install enclosure in relation to power
   4. Size the enclosure to support all PACS devices noted on the drawings and in the specifications.
   5. Provide magnetic cable support devices in the panel to route cables inside the panel to the controllers and power devices
   6. Power.

a. Install cabling and raceway to connect the power supply in the enclosure to the 120 volt power outlet.
b. Shall be hard-wired power. Plug-in power is not allowed
c. Provide an electrician for connection of the power supplies if required by AHJ.

7. Battery backup
   a. Provide and connect the batteries to the power supply for the enclosure
   b. Test the battery supports the panel by removing 120 volt power after the system is fully up and operational.
8. Network connectivity
   a. Provide and install CAT-6 cable from the enclosure for the power supply to the communications rack. Connect to the Ethernet switch
9. Other Controllers and I/O Board connectivity.
   a. Provide and install cabling to connect the Ethernet controller to the other controllers and I/O boards via RS-485.
   b. Do not install RS-485 between communications rooms. Each comm room shall have an Ethernet attached Controller.

B. Controller:
1. Controller(s). shall be mounted in the enclosure as shown on the drawings.
2. Controller shall be sized for all security, access, control, and monitoring points existing on the drawings and shall be expandable.
3. Controller shall be able to be linked to additional controllers in other communications rooms/buildings via the Ethernet network.
4. Each port in the controller that is connected to a security point shall be labeled inside the controller box.
5. Label the outside of the panel with the door numbers and list of devices that are connected in that panel. Shall be laser printed adhesive labels.
6. Label the inside of the panel door with the layout of the panel and which controllers attach to which devices. Include door numbers on the diagram.
7. Depending on the type of panel the contractor shall provide cable routing hardware and equipment to neatly install cabling.
   a. Route cable to allow easy change and replacement of the individual control cards in the panel.
   b. Cabling shall be neatly bundled. See example below of adequate cabling being routed into a panel.
8. Network connectivity
   a. Provide and install CAT-6 cable from the controller to the communications rack. Connect to the Ethernet switch
   b. Connect on the Ethernet to the Switch.

C. Plywood behind panels.
1. Install all panels onto plywood in each comm room.
2. Paint plywood with prior to installation on the wall.
3. Plywood shall be installed from 12 inches AFF to 7 feet above the floor or as noted on the drawings.
4. Mount plywood to the wall with screws attached to studs in the wall. Contractor is responsible for securely mounting the plywood to the wall.
5. Grade “A” side of the plywood shall be used for mounting all communications components.
6. If the plywood will cover an electrical receptacle, the Contractor shall cut the plywood to allow access to the receptacle.

3.05 SERVER AND SOFTWARE INSTALLATION

A. Management Server:
1. Server/appliance is existing for the existing Lenel S2 On Guard system
2. Contractor shall provide and install software and licensing required to add devices and panels to the existing system.

B. Control Software:

1. Contractor shall provide all software required for a fully functional security/access system.
2. Software shall be installed and fully configured by the Contractor.
3. Contractor shall schedule meetings with the Owner prior to installation to determine the working of the security/access system.
4. Configuration of the security software shall include but not be limited to the following:
    a. Number each door and any input and outputs associated with that door and associate it with a standard door name for easy review.
    b. Meet with the owner to determine how they will use the system. Take information from them that will allow all custom settings of the software system. This shall include but not be limited to:
        1) User groups based on building and administrative group
        2) Access levels based on groups and times.
        3) Door Groups for access and locking and unlocking schedules.
        4) Building locking and unlocking schedules for each building
        5) Administrative levels and super administrators
        6) Building arming and disarming schedules of door contacts
        7) Alarm level setting for different doors based on time of day and day of week.
        8) Lockdown and Normal locking schedules. Configure the system to lock all doors upon going into lockdown mode through the button or through the software system.
        9) Snow-Day override schedule that shall change when doors unlock and lock and which users or user groups are allowed to access the building during a snow day. Snow day shall revert back to regular scheduling afer 11 PM that day.
        10) Setup all user logins to allow specific viewing of portions of the system based on login ID.
            A) Detail in the setup that persons rights in working in the system.
    c. Lockdowns and Secure
        1) Create different locking schedules and processes for Lockdowns and Secure situations.
        2) Work with the owner to determine what doors are locked or unlocked in a lockdown or secure situation.
        3) Make all settings and groups required for each situation.
    d. Set all alarm levels and outgoing outcalls for SMS and email alerts.
        1) Add users and all those that are to be notified on a building basis.
        2) Set levels for all door contacts such that the owner is notified of a door open when the system is armed but is not alerted during the day unless they ask for this type of configuration.
    e. Generate customized maps for each building.
        1) Create maps from the owner that have multiple levels such as entire building and then subdivided into different areas.
        2) The maps shall show icons for each door. The icons shall be green or red based on open or closed door.
        3) Setup all icons to allow the owner to click on a door and then have direct access to lock or unlock or pulse the lock on a door.

3.06 CREDENTIALS

A. All Physical Credentials and users are existing in the system
    1. Associate new door devices with the owners existing groups of people
    2. Configure specific new door devices with individuals as directed by the owner.
    3. Work with the owner to apply system privileges and door access to each individual user.

3.07 DOOR LOCKING CONNECTIVITY

A. Electric Strike “ES” on drawings

1. The note devices shall be installed by the door hardware contractor.
2. Power supplies shall be located in the comm room. Provide and install power supplies. Connect power supplies to the controller panel.
3. Install all cables required to be connected this device to the security system
4. Review door hardware specifications to determine if a wiring harness is being provided by the door hardware supplier.
    a. Install cables from the controller panel and power supply in the comm room to the wiring harness. Connect to harness
    b. For EL devices, install harness from door hardware EL to the hinge, through the hinge and to the connection point for cables from the controller.
    c. For ES devices, install cabling from security panel to the Electric strike in the latch side of the frame.
    d. Wire from device, through frame and back to controller/power supply in the comm room.

B. Latch Retraction device. “LR” on drawings
1. The Latch Retraction devices shall be provided by the door hardware supplier.
2. Power supplies shall be located in the comm room. Provide and install power supplies. Connect power supplies to the controller panel.
3. Install all cables required to be connect this power supply to the security system and to the actual Latch Retraction lock at the door.
4. Review door hardware specifications to determine if a wiring harness is being provide by the door hardware supplier.
    a. Install cables from the controller panel and power supply to the wiring harness. Connect to harness
    b. Install harness from door hardware LR to the hinge, through the hinge and to the connection point above the door.
    c. Wire from connection point above door to the power supply and then to the security panel.
    d. If no harness is provided, then wire from LR device, thru the hinge, to the power supply controller and finally to the security panel.

C. Chexit Latch Retraction device. “CX” on drawings
1. The chexit devices shall be provided by the door hardware supplier. They have a local alarm.
2. Power supplies shall be located in the comm room. Provide and install power supplies. Connect power supplies to the controller panel.
3. Install all cables required to be connect this power supply and alarm shunt trigger to the security system and to the actual Chexit lock at the door.
4. Review door hardware specifications to determine if a wiring harness is being provided by the door hardware supplier.
    a. Install cables from the controller panel and power supply to the wiring harness. Connect to harness
    b. Install harness from door hardware CX to the hinge, through the hinge and to the connection point above the door.
    c. Wire from connection point above door to the power supply and then to the security panel.
    d. If no harness is provided, then wire from CX device, thru the hinge, to the power supply controller and finally to the security panel.

3.08 READER INSTALLATION

A. Card Readers “CR” on drawings
1. Card readers shall be installed at locations shown on the drawings.
2. Review site and drawings and coordinate the wall mounted readers and frame mounted readers. Order the correct reader for each location.

a. Conduct a site visit prior to ordering card readers.
b. If the wrong reader is ordered then the contractor shall provide the correct reader.

3. Coordinate installation of all card readers with the doors and walls.
4. Where the reader is mounted on the door, coordinate the installation with the installation of the door to allow all cable for security/access.
5. Locate all card readers at ADA compliant heights and locations.
6. Wire and configure the card readers so that when the lock is engaged the light on the reader is red and when the door is unlocked the light is green.
7. Garage Doors and Pedestals: At the garage doors and at pedestals the card readers shall be installed with a box that has a cover for the top of the card reader.

3.09 DEVICES AT THE DOOR

A. Door Contacts “DC” and Garage contacts “GC”:
1. Install contacts where shown on the drawings. For mandoor contacts, install them at the top of the door.
2. Work with door provider and installer on timing of door contact installation.
3. Install raceways to allow installation of the door contacts if no raceway is provided inside the wall.
4. Drill into the door frame and door to allow installation of the door contact and the associated cable. No cable shall be visible after installation.
5. Where door frames are filled, they shall be drilled out to allow installation of the door contact. Surface mount contacts are not allowed unless specifically noted on the drawings.
6. Wire back to the PACS panel and connect as an input.

B. Motion Request to Exit devices: “MX” on drawings
1. Where shown on the drawings install a passive infrared motion-based request to exit device.
2. Associate this with one or more doors so that when it senses motion it shunts the door contact.
3. Wire this back to the panels in the comm. rooms.
4. Install above the door.

C. Request to Exit Devices “RX” on drawings
1. When the RX is shown, wire from this device in the lock/pushbar, back to the controller in the comm room.
2. Set this up to shunts the door contact when triggered.

D. Embarrassment Alarm, “EA”. Shall be mounted to the wall or ceiling. Determine at location in the field.
1. Provide raceway and backbox for the alarm.
2. Wire to the security systems. This alarm shall engage for a set length of time when the lockdown button is pressed.
3. Set the owner requested length of time. Test that the alarm goes off either when the contact is re-engaged or the time expires.

E. Release Button “RB”
1. The door release is meant to release a magnetic lock when exiting from a secure side to an unsecure side.
a. Wire back to the PACS and configure to unlock the door.
2. The Release Button is meant to release an electronic lock when entering from the secure side to the other side of the door.
a. Wire back to the PACS and configure to unlock the door.
b. Work with the owner to set a schedule to when this RB can be engaged and when it will not operate. Such time may be after hours or during a lockdown.

F. Door Position switch. “DP”
1. Wire back to the access control system.

2. Configure the system to note and use the position of the door to allow or disallow different events
3. Work with the owner on configuring the system to act, alarm or not allow something based on the door position switch state.

3.10 ASSISTED OPENER FOR ADA

A. Assisted Opener: “AO” and assisted button “AB” on drawings
   1. Where an assisted opener is shown the contractor shall wire to this opener and associated opener buttons (“AB”) to work as noted on the drawings and as below:
   2. Operation sequence when the doors are locked entering from outside -valid id card
      a. If the person presents a valid card then the latch shall retract inside the exterior door.
      b. The door shall hold unlocked for 15 seconds.
      c. The control board shall allow the exterior push button to be energized. Once the push button is energized then the exterior door shall be opened if the button is pushed.
   3. Operation sequence when the doors are unlocked entering from outside
      a. Push the ADA button Exterior door opens
   4. Operation sequence when the doors are locked entering from outside -no card or invalid card
      a. If the person pushes the exterior opener button, then the auto opener shall not engage because the opener button is not energized.
      b. The exterior opener button is not energized unless the PACS notes that the door is unlocked.
   5. Operation sequence when the doors are locked, exiting from interior
      a. When a person pushes the interior opener button then that shall communicate with the interior auto opener and open that door.
      b. The control board of the auto opener shall communicate with the access control system and instruct it to retract the latch on the interior door.
   6. Operation sequence when the doors are locked, exiting from vestibule
      a. When a person pushes the vestibule opener button then that shall communicate with the exterior auto opener and open that door.
      b. The control board of the exterior auto opener shall communicate with the access control system and instruct it to retract the latch on the exterior door.

3.11 FIELD DEVICES

A. These devices shall be connected to the PACS and shall provide inputs or act upon outputs to accomplish their tasks.
B. Wire from each of these devices to the PACS
C. Configure each device as an input or receiver of an output.
D. Test each device.
E. Contact Closure “CC” or Security Contact “SC”
   1. This shall be either an input or output
   2. Use this connection to trigger the system at the other end or receive a trigger or contact closure from the other device.
   3. An input may set in motion multiple outputs. Configure each as per the owner’s requirements.

3.12 DEVICES AT THE OPERATOR DESK

A. These devices shall be connected to the PACS and shall provide inputs to the system. Setup actions that occur after the device initiates a trigger to the PACS.
   1. Work with the owner and configure the system to initiate or stop any devices based on the input from the device.
B. Wire from each of these devices to the PACS
C. Test each device.
D. Toggle Switch “TS” , Push Button “PB, Lockdown Button “LB”
   1. Wire each button and each light if so equipped

2. Provide the correct cable to support full use of the button or switch or control of the LED light
3. Install the toggle switch on the desk or under the desk.
   a. Mount to a backbox with blank stainless steel plate if it is not possible to mount directly to a desk.
4. Mount each device to the furniture at location identified by owner.
5. Wire back to system. Configure system to have two or more states. One for each switch position. Talk to owner to identify the states required.
6. Meet with owner to discuss how buttons shall be configured.
7. Lockdown button shall have a light and it shall be lit when the system is in “LOCKDOWN”. When the lockdown button is reset the light shall go out and the entire system shall return to regular schedule.

3.13 INTERCOMS AT THE DOORS

A. IP Intercoms
   1. Intercom at the door shall be installed based on the type chosen and specified in specs and drawings.
   2. Where the Intercom is surface mounted.
      a. Surface mounted units shall be connected to the interior of the building with a conduit and steel backbox.
      b. Where possible route the cables through the door or wall framing and extend to the intercom.
      c. Install raceway from bottom of intercom to lower pushbutton.
      d. Ensure installation of lower button to meet ADA requirements
   3. Flush-mounted intercoms
      a. Provide and install the custom backbox at the intercom location.
      b. Provide notice to electrician to allow them to install conduits to accessible ceiling.
      c. Review and ensure raceway from bottom of intercom to lower pushbutton is installed.
      d. Ensure installation of lower button to meet ADA requirements
   4. Wire the lower pushbutton to the intercom to support initiation of an intercom call
   5. The intercom device shall be located at a place where it is accessible and where it can be mounted to see the person calling.
      a. Camera shall be positioned to cover the maximum area possible.
      b. Install a connection cable from the exterior interface to the interior unit and door lock.
      c. Install any baluns, adapters, or other devices required to send the signal from the exterior intercom to the network.
      d. Provide CAT-6 patch cables
   6. IP Programmable Relay.
      a. This device shall be mounted in the main communications room.
      b. Connect to the Ethernet network with appropriate CAT-6 cabling
      c. Connect to the controllers to allow the base station to unlock the associated door.
      d. Integrate so that the base station only controls the door that the call was initiated from.
   7. Base stations shall be located as shown on the drawings.
      a. The devices shall be configured to allow the Owner to unlock the door when a person calls in and is determined to be acceptable for entry.
      b. The master control devices shall interface with the access control system through the IP Programmable relay to interrupt any alarms and momentarily unlock the door.
      c. Configure they device to allow the user to determine which door the call is coming from and then unlock only that door.

d. Provide all cabling and other equipment required to connect the base station to the Ethernet network. CAT-6 cable, Plenum Rated.

END OF SECTION 28 3500

SECTION 28 3600 – SECURITY RECORDING

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. This section includes parts and equipment required for installation and configuration of a video security system. This system shall be referred to as the "security system" throughout these specifications.

1.02 SYSTEM DESCRIPTION

A. The security system shall be supplied and installed by a Contractor able to show examples of similar projects and installations within the last 3 years.
B. The video security system shall serve the building(s) shown and be able to be expanded to support other buildings attached to the data network
C. New cameras shall be IP cameras with direct connection to Ethernet Switches.
D. Software and hardware shall allow for monitoring from any PC attached to the data network.

1.03 COORDINATION

A. Coordinate with the network contractor. Provide IP addresses and ports the cameras are connected to in an excel spreadsheet to the network contractor for VLAN configuration
B. Coordinate with data cabling contractor. Walk the site and identify all camera locations and make the cabling contractor aware of all camera locations.

1.04 PROJECT PLAN

A. The contractor shall provide a project plan to the owner and contractor that describes the system and its capabilities and the possible configurations.
B. Provide a project approach which describes the installation and implementation plan and schedule and all sequencing.
C. Meet with the owner numerous times to determine how the system should work and how it should be monitored. Configure the system prior to installation to meet these requirements. Demonstrate the system use to the owner prior to installation and obtain approval to move forward with the installation.
D. Provide shop drawings showing all configuration and connectivity of the system.
E. Generate a testing plan and have that plan approved by the owner and engineer prior to installing the system.

1.05 RELATED STANDARDS

A. The security system shall conform to the following international and national standards:
   1. FCC Rules and Regulations
   2. UL 294 Access Control Systems
   3. UL 1076 Line Supervision
   4. 21 CFR part 11
   5. Part 15, Radio Frequency Devices
   6. National Electrical Manufacturers Association (NEMA)
   7. Applicable Federal, State and Local laws, regulations, codes
   8. Americans with Disabilities Act (ADA)
   9. National Electrical Code (NEC)

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Approved vendor for video security camera recording software is:
   1. Digital Watchdog
   2. No others are allowed

2.02 VIDEO MANAGEMENT SOFTWARE (VMS)

A. The VMS shall be Digital Watchdog.
   1. Provide additional licenses to existing system to support new server.

2.03 VIDEO SECURITY HARDWARE

A. Network Video Recorder shall be Digital Watchdog Blackjack AI Server
B. Network Video Recorder (NVR):
   1. The Contractor shall provide an NVR or multiple NVR's that connect to all the video cameras. Size the system to accept additional cameras to be installed in the future. See drawings and/or specs for quantity

a. The NVR shall be a central control and storage system that allows the Owner to view and review images from any or all cameras.

2. NVR and associated storage shall be of the latest manufacture and software release available.
3. Shall supply multiple simultaneous playback streams.
   a. The system shall allow all PC's attached to the wired Ethernet network to view cameras at full resolution on their PC.
   b. Size the processor of the NVR and Monitoring PC to allow viewing of up to 32 cameras at the monitoring PC without any slowness or loss of signal.
4. The NVR shall be capable of continuous, schedule, alarm/event, and motion recording, shall have pre- and post-alarm recording and shall be fully programmable on a per-channel basis.
   a. Any motion sensing shall be assumed to be done at the server. Use this for servers sizing.
   b. See specifications below for recording parameters.
5. The NVR shall have expandable storage capacity to allow additional storage of video. The expandable storage shall be easily added and integrated into the system.
6. The network video recorder shall offer plug-and-play configuration for cameras.
7. The network video recorder shall provide performance enhancement and fault tolerance by employing RAID-5 style redundancy across multiple disk drives and shall feature a hot drive swap that automatically configures the drives when installed.
   a. Where the Video Management Software (VMS) requires, the Immediate recording shall be to High-Speed drives.
   b. Images can then be moved to slower, long-term storage devices.
   c. Provide these drives based on the VMS being installed.
8. The network video recorder shall meet or exceed the following design and performance specifications:
   a. Processor:
      A) No less than Two, Quad-core processors, Intel® Xeon 5600 series® 4, 2.8 GHz or equal.
      B) 64 Bit
      C) Provide calculations from the software manufacturer and camera manufacturer to prove processing and storage submitted will meet system requirements
      D) Provide the actual throughput and quantity of storage being provided and note how it meets calculations from the software manufacturer and the camera manufacturer.
   b. Internal Memory:
      A) 16 GB minimum.
   c. Operating System:
      A) Linux or Microsoft. (provide any operating system software)
   d. User Interface:
      A) Remote operation from standard Windows 10 PC's.
      B) Shall be equipped with web interface to allow viewing of live and recorded video through a standard web browser.
      C) Shall allow and be equipped with software and hardware to allow viewing of live video on a tablet or smartphone device.
   e. NVR throughput:
      A) Server throughput shall be the capacity of the server(s) to process incoming live and recorded video. This shall be a function of the processing power of the NVR/server.
      B) It shall provide for processing, live viewing, remote viewing and recording capacity to record on all cameras at:
         1) 15 frames per second.
         2) Constant recording of all cameras

3) Compression shall be no higher than 30%. Thus if full bandwidth of the camera is 100 then configuration shall be no less than 70 on a 1 to 100 scale.
4) 8 users viewing 16 cameras each

C) Thoughput shall be calculated at maximum camera resolution of the specified cameras. Throughput required shall be calculated for cameras that are part of this project plus to include fifty (50) future cameras at 3840x2160.
D) Throughput shall include processing of the cameras shown plus future additional cameras as noted on the detailed drawings.

f. Video image storage: This shall include the amount of disk storage space required to store all the images from the cameras. Storage space shall be calculated based on:
A) Recording images on all cameras at 15 frames per second,
B) Assume recording on movement rates of 40%.
C) Additionally, each camera shall record 1 frame per second when there is no motion.
D) Storage for 30 days.
E) Storage shall be calculated at maximum camera resolution of the specified cameras. Storage required shall be calculated for cameras that are part of this project plus to include fifty (50) future cameras at 3840x2160.
F) Include processing of the cameras shown plus future additional cameras noted on the drawings.

g. Total Capacity shall be calculated by Contractor. Provide calculations if you are asked to present your solution or if you are the chosen bidder.
h. Hard drives shall be internal or part of an external storage array. All discs shall be configured in a RAID 6 redundant style array such that losing any single drive will not mean a loss of recorded images.

9. Each NVR Shall have dual power supplies.
10. The NVR shall have One (1) 10 Gigabit Ethernet connection(s) via an RJ-45 copper or Fiber Optic type interface.
a. If the interface is a fiber Optic connection then provide the equal SFP module for the Ethernet switch that is being used to connect the Ethernet Switch
11. The NVR shall be 19 inches rack mountable.
12. The NVR Servers shall be supplied with no less than three years of 24x7 maintenance that includes next day replacement of drives and service on the server.
13. Servers shall be from the following manufacturers
a. Digital Watchdog BlackJack AI server

PART 3 - EXECUTION

3.01 EXAMINATION

A. Review site and note locations of cameras, conduits and cables prior to installation.
B. Review all ceiling styles on the reflected ceiling plans. Provide mounts as required based on the ceiling style.

3.02 INSTALLATION

A. The Network Video Recorder (NVR) shall be mounted in the Creek side Data Center.
1. Mount the NVR in a cabinet/rack. Connect to the local area network as required for complete system connectivity.
2. Connect the NVR and all cameras to the Ethernet network.
a. No less than two Gigabit Ethernet Connections
3. Connect the power supplies of the NVR to the UPS.
4. After full configuration of the system the contractor shall copy the complete configuration to another of the owner’s servers and shall provide a CD or USB drive copy of the configuration.

a. Contractor shall keep a copy of the original configuration of the server and all cameras at their site.
b. Provide the information to the owner on a CD or USB Drive.
c. The backup of the configuration shall provide the owner an easy way to reconfigure the system in case of a total system failure or a new server installation is required.

B. Fully configure the Video Recording and Control Software.
1. The Contractor shall meet with the Owner prior to installation of the system to discuss all aspects and abilities of the NVR and VMS and the attached cameras.
2. The Contractor shall present all configuration options to the Owner to get their input and let them choose how the system is to be used and configured.
3. The Contractor shall take information from the meeting and record that in meeting minutes. Provide copies of these minutes to the Owner and Designer
4. The Contractor shall configure and install the system as requested by the Owner and as shown on the drawings and specifications.
5. The servers and storage shall be configured based on the manufacturer's recommendations.
a. Discuss drive array and recording processes with the owner and manufacturer prior to installation of the system
b. Discuss recording block size with the manufacturer prior to installation.
c. Meet with the owner and discuss the server(s) setup and present a document from the NVR software and server manufacturer to demonstrate how the system will be configured.
d. Evenly distribute cameras and recordings across all servers.
6. Configuration of the system shall include but not be limited to the following.
a. Labeling of all cameras in the system to match the owner approved labeling scheme as well as their chosen specific descriptive name.
b. Video blanking of any areas on each camera if there are areas that are not to be seen or recorded by the NVR system.
c. Passwords and logins for users and administrators. Include in this a list of all the users and their access levels.
d. Recording Frames per second, resolution and long term recording resolution.
e. Generation and configuration of any presets for PTZ cameras including tours and timing.
f. Specialized recording times for each camera including additional FPS or resolution at times of the day.
g. Backup times and all data to be backed up. Configure scheduled backups
h. Aiming, focusing and framing of all camera images.
A) Sit with the owner and review each camera's view and custom set the aiming, framing and focus of each camera.
B) Have someone at the camera while reviewing that is able to move and aim and focus the camera.
C) Download an image from the camera as the owner wishes it to be aimed
D) Create a spreadsheet with each camera and have the owner sign off on the aiming of each camera.
i. Generation of custom views for all user software. Meet with each person that is allowed to view the cameras and help them generate a custom view of the cameras they wish to see.
7. Contractor shall fully load and match all maps to the video security system. Install all maps and load all camera locations and hot buttons to the maps to allow quick connect to the cameras based on clicking on the camera location on the map.
a. Each camera button shall show the camera number.
8. Recorded images and offloaded images shall be able to be time-stamped with the date, camera number and exact time down to the second when the video was recorded.

a. This shall be able to be seen on the viewing station and shall be attached to the video when it is offloaded and viewed on an outside player.
b. Setup the server and software to obtain time from the national standard time.

C. Connect the storage to the new NVR servers and the rest of the servers.
1. Configure the storage to provide service to all users and all storage requirements.
2. Meet with the owner prior to installation and present all options to the owner in regards to the configuration options. Assist the owner in deciding which options best meet their needs.
3. Publish a plan and configuration parameters of the storage and ensure that everyone agrees with the plan.
4. Install the storage and connect to all servers.

D. Analytics Configuration.
1. Analytics may be in the VMS or at the camera. Contractor shall setup each camera that is able to provide analytics. Shall be setup on the camera and the VMS
2. Setup the system to support alerts and search of recorded video based on metadata collected thru the analytic.
3. Include time in the contract to work with the owner to determine which analytics shall be setup and on which cameras the analytic shall be setup.
4. Identify each camera and what analytics shall be setup.
5. Create a document that details the available analytics and on which cameras they are available.
6. Setup the analytic to alert the owner thru the VMS when a threshold setup is exceeded.
7. Setup the VMS to support search using metadata captured by the analytic.
8. Test the analytic at each camera and throughout the entire VMS for live and recorded video.

E. Ethernet systems configuration shall be coordinated with the IT department. The owner will work with their contractor to switch the network to a security VLAN and other QOS parameters as required by the security system.
1. Meetings shall be scheduled with the Owner to discuss the configurations of all electronics and the capabilities of the system.
2. The owner shall be made aware of all the capabilities of the video security system and all possible configurations and shall be able to decide all aspects of the programming and configuration.
3. The Contractor shall generate a report on the requirements of the owner and shall work with the owner to help determine the configuration of all the data electronics to meet the security systems needs.
4. From the meetings the owner and contractor shall generate a plan for all configuration issues of the data network including but not limited to:
a. IP Numbering Scheme
b. VLAN settings
c. Quality of Service (QoS) settings
d. Network Prioritization
e. New data connections.
f. Wireless connectivity for Visitors, Students and Administrators.
g. Wireless Security
5. The network electronics shall be configured to synchronize internal clocks to a designated internal NTP server.
6. The network electronics shall be configured with the same time zone settings and said time zone shall be the local time zone.

END OF SECTION 28 3600

SECTION 28 3700 – SECURITY CAMERAS

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. This section includes parts, equipment and cabling required for installation of the video surveillance cameras.

B. This shall include new IP video cameras and their cabling/termination equipment as shown on the drawings and detailed in the specifications.

1.02 COORDINATION

A. All cables shall be coordinated with the installation of the raceways.

B. All cameras shall be installed in the ceilings in relation to the lights and other obstructions.

1.03 DESCRIPTON

A. Provide new IP cameras for video surveillance. See the detailed security drawings for location and quantities.

B. Cameras shall be pure IP cameras without the use of external encoders/decoders where possible.

C. Power for interior and exterior cameras shall be provided via the POE switch or via a centralized power supply in the communications room.

1. The switches installed provide standard Type 3 PoE (15.4 watts) on each port. If a camera requires additional power above Type 3 PoE then the contractor shall provide that power supply and any additional required power cables.

D. PTZ cameras that require additional power above that provided from a Type 3 PoE connections shall be provided with a power supply.

1. Provide any and all camera, power and control cables required for complete system connectivity and functionality.

E. It shall be the Contractor’s responsibility to provide all power to cameras based on the above methods. Take into account the Manufacturers recommendations.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Approved Manufacturers for IP cameras:

1. Digital Watchdog

2.02 CAMERAS GENERAL REQUIREMENTS

A. Cameras shall provide full color images and some shall change to black and white in low light.

B. Cameras shall support text overlay of image in viewing to allow naming/numbering of each camera on the screen and when video is offloaded.

C. The Contractor shall review the site with the Owner prior to ordering the lens for each camera.

1. Finalize the needs of the Owner with the camera position to ensure that the correct lens is purchased for the camera.
2. Review actual installation location prior to ordering cameras. Purchase correct mount for camera. All cameras in drop ceilings or hard ceilings shall be installed with recessed camera mounts.

D. Where noted on the drawings, provide a vandal resistant dome to the camera.

E. Where cameras require more power than PoE 802.af then the contractor shall provide power to the camera from a centralized power supply in the comm. room.

F. External Cameras

1. Each exterior camera shall be equipped with a heater/blower or other device to keep camera functional and keep lens/casing from fogging or condensation from forming.
2. Provide mounts for exterior cameras based on their installation location. Provide fully enclosed mounts. See drawings and conduct a field survey prior to ordering to ensure that he correct mounts are provided.
    a. Exterior mounts shall allow cable entry to the dome via the support. No cables shall be exterior to the mount or dome.

2.03 CAMERA -4K 180 DEGREE BULLET STYLE CAMERA -OUTDOOR

A. MEGApix Ai 4K Ultra-Wide Angle Pano Bullet camera

B. Shall include all mounts and hardware for indoor or outdoor installation

C. Camera shall include:

1. Star-Light Plus, 2.3mm ultra wide lens,
2. AI Deep Learning,
3. 1/1.8 Image Sensor,
4. Triple Codecs (H.265, H.264, MJPEG),
5. True Wide Dynamic Range,
6. 100ft Smart Infrared
7. Two Way Audio,
8. Micro SD/SDHCC/SDXC class 10 card slot(card not included),
9. PoE and 12Vdc power
10. Shall be ONVIF Profile S and NDAA/TAA Compliant,
11. Shall include a 5 Year manufacturer Warranty.
12. Camera shall be Digital Watchdog # DWC-XSBC08Bi
    a. Exterior cameras shall be equipped with a heater and correct mount.

2.04 CAMERA -4K 180 DEGREE BULLET STYLE CAMERA -INDOOR

A. MEGApix Ai 4K Ultra Wide Angle Wall Mount Pano wall mount, indoor camera
B. Shall include all mounts and hardware for indoor installation
C. Camera shall include:
1. Star-Light Plus, 2.3mm ultra wide lens,
2. AI Deep Learning,
3. 1/1.8 Image Sensor,
4. Triple Codecs (H.265, H.264, MJPEG),
5. True Wide Dynamic Range,
6. 100ft Smart IR,
7. Two Way Audio,
8. Micro SD/SDHCC/SDXC class 10 card slot(card not included),
9. PoE and 12Vdc power
10. ONVIF Profile S and NDAA/TAA Compliant,
11. Shall include a 5 Year manufacturer Warranty.
12. Camera shall be Digital Watchdog # DWC-XSWA08Bi

2.05 CAMERAS 360 DEGREE -SINGLE SENSOR, INDOOR/OUTDOOR

A. MEGApix Fisheye Indoor/Outdoor Vandal Dome,
B. Shall include all mounts and hardware for indoor or outdoor installation
C. Camera shall include:
1. Star-Light Plus,
2. 9 Megapixel, 360 and 180-degree Panoramic view with Edge to Edge Clarity,
3. 1/1.7 Image Sensor at 30fps ,
4. Multi Codecs (H.265, H.264, MJPEG) with Simultaneous Dual Streams,
5. 80ft Smart IR,
6. True Wide Dynamic Range with Mechanical IR Cut Filter,
7. Two Way Audio,
8. Auto Gain Control (AGC), Auto White Balance (AWB), Motion Detection,
9. Micro SD/SDHC Class 10 Card Slot (card not included),
10. OnVIF Profile S, and NDAA compliant
11. IP66, IK9 rated
12. POE and DC12V,
13. Shall include a 5 Year manufacturer Warranty.
14. Camera shall be Digital Watchdog # DWC-PVF9Di2TW

2.06 CEILING OR WALL MOUNTE DOME 4K INDOOR/OUTDOOR CAMERA

A. MEGApix IVA Indoor/Outdoor Vandal Dome Camera,
B. Shall include all mounts and hardware for indoor or outdoor installation
C. Camera shall include:
1. Star-Light Plus, 4K ,
2. Star-Light Plus, 2952x2320 @ 30fps,
3. 2.8 Fixed Lens,
4. Ai Deep Learning

5. 100ft Smart IR,
6. True Wide Dynamic Rante
7. Triple Codecs (H.265, H.264, MJPEG) with Simultaneous Streaming,
8. Two Way Audio,
9. PoE Class 3 and DC12V power
10. OnVIF and NDAA Compliant,
11. Micro SD/SDHC/SDXC class 10 card slot (card not included)
12. IP66, IK10 rated
13. Shall include a 5 Year manufacturer Warranty.
14. Camera shall be Digital Watchdog # DWC-XSDE08Mi

2.07 CAMERAS MULTI-SENSOR 180-270-360 DEGREE VIEWING

A. MEGApix 20 Megapixel Flexible Panoramic Indoor/Outdoor Vandal Dome (4 cameras in 1), 360 and 180 Panoramic View,
B. Shall include all mounts and hardware for indoor or outdoor installation
C. Camera shall include:
1. Four (4) 5 MegaPixel (MP) Sensors
a. Angle of view
b. Horizontal Field of view (HFoV): 4x 51° ~ 93°
c. Vertical Field of view (VFoV): 4x 39° ~ 68°
2. 4x2.8-8mm varifocal motorized zoom lenses,
3. 1/3" Image Sensors,
4. Flexible sensor positioning with magnets,
5. Triple Codecs (H.265, H.264, MJPEG) with simultaneous Dual Streams,
6. True Day/Night with Mechanical IR Cut Filter,
7. True Wide Dynamic Range
8. Two Way Audio,
9. Auto Gain Control (AGC), Auto White Balance (AWB),
10. Motion Detection,
11. Micro SD/SDHC Class 10 Card Slot (card not included),
12. OnVIF Profile S and NDAA Compliant
13. IP67 rated
14. PoE Class 4 and DC12V PoE Injector to be Included, NDAA,
15. Shall include a 5 Year manufacturer Warranty.
16. Intelligent Video Analytics inside.
17. Camera shall consist of multiple image sensors arrayed to provide a cohesive image in 180/ 270 degrees or 360 degrees or 270 degrees with one sensor facing down.
18. Camera shall be Digital Watchdog # DWC-PVX20WATX

2.08 CAMERA ACCESSORIES

A. Camera Mounts:
1. The Contractor shall provide all appropriate camera mounts. Refer to the drawings and conduct a site survey to determine each camera mounting type required.
a. Complete this prior to ordering cameras.
2. Exterior cameras shall be mounted to the wall of the building in most cases.
a. Where the camera is to look along the wall of a building the contractor shall provide an arm/pendant mount that mounts the camera parallel to the ground.
b. Mount shall extend the camera out from the building a few inches to allow viewing in 360 horizontal degrees
c. Corner mounts shall be installed where the camera is shown to be corner mounted.
1) Provide flexible raceway to extend cable from the building or backbox and into the
3. The security cameras shall be mounted to building structure where shown on the drawings.
a. Contractor shall provide a mount that best corresponds to the structure and can be securely mounted.

b. Mount the camera at a height as shown on the drawings or at the optimum height to allow the best field of view and future service via extension ladder.
   1) Unless specified the cameras on the exterior of a building should not be installed more than 15’ above grade.
c. When mounting the cameras, take into account the light and mount the camera so that it does not block light.
d. The camera mount shall provide a route for cables extending from the raceway to the camera. Cables shall not be installed outside the camera dome or camera mount.
e. The Contractor shall install a conduit to allow cable installation to the camera.
   1) This shall include installing conduits from the inside of the building to the outside of the building to support exterior cameras.
   2) Core through the outside of the building. Coordinate location with owner and architect prior to drilling.
   3) Install ¾ conduit or sized as per the mount.
   4) Except for corner and parapet mounts no conduits shall be visible after installation.
   5) At no time shall a cable be visible. Install flexible conduit and seal appropriately around holes made in the building
   6) Repair wall after installation.
   7) No cable shall be visible after camera installation.

4. Dome-type cameras interior to a building may be installed in the lay-in ceiling.
   a. Provide supports so that the camera’s weight is supported from the “T” bars of the drop ceiling.
   b. Provide a backbox and escutcheon to make a tight fit from the dome to the drop ceiling tile.
   c. Locate the cameras to cover the area required by the Owner. Work with the Owner prior to installation.
5. Dome-type cameras interior to a building may be installed as a pendant mount from the building structure.
   a. Provide a backbox at the building structure. Install a downpipe and camera mount to attach the camera to the downpipe. Size the pipe as required.
   b. The camera mount shall keep the camera level and shall extend down to a level of no more than 11’ AFF.
   c. Locate the cameras to cover the area required by the Owner. Work with the Owner prior to installation.
6. Dome-type cameras interior to the building may be required to be mounted to a wall.
   a. Where there is a wall mount requirement, the Contractor shall install a wall-mount. Ensure that it is securely mounted.
   b. Route the cable through the wall and through the mount to connect to the camera.

B. Camera accessories.
1. Contractor shall provide and install any and all accessories required for complete mounting, configuration and power delivery.
2. Pendant NPT adapter Avigilon #H6A-MT-NPTA1
3. Pendant wall arm, 1.5" NPT female, 20 cm (7.8") long Avigilon #WLMT-1021
4. In-Ceiling adapter Avigilon #CLADP-1001
5. Metal ceiling panel for suspended ceiling installations Avigilon #CLPNL-1011
6. Weathershield for dome cameras Avigilon #DMSLD-1001
7. Camera sealing grommet, pack of 1 Avigilon #0GROM-1001
8. Pipe sealing grommet, pack of Avigilon #10GROM-1011
9. Pole mount adapter Avigilon #PLMT-1001
10. Corner mount adapter Avigilon #CRNMT-1001

2.09 CAMERA INSTALLATION ACCESSORIES

A. Firestopping shall be completed inside and around all conduits after cable installation. Contractor shall install the best firestop for each individual installation.
   1. Firestop shall be installed with regard to local and national building codes.
   2. The firestop shall be a putty-like substance that expands under heat and will not allow flame to pass for a designated period of time.
   3. Firestop shall conform to all NEC, NFPA, and UL requirements.
   4. Some wall pass-thru's are shown on the drawings. The Contractor shall utilize these where possible.
   5. Where the contractor must install cables through a wall where there is no pass-thru already provided, the Contractor shall be responsible for installing a fire-rated pass-thru and fire-stopping the conduit after cable installation.

B. Weatherproofing shall be completed inside and around all conduits supporting exterior cameras after cable installation. Contractor shall install the best weatherproof for each individual installation.
   1. Weatherproof around all conduits that extend through the building to the cameras on the exterior wall or soffit.
   2. Seal all cameras so that all camera housing does not allow water into the conduit or into the building.
   3. Seal so there is no infiltration of water or condensate.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine all pathways prior to installation of all cables.
B. Identify locations of all user conduits and backboxes prior to cable installation.
C. Review site and note locations of cameras and conduits prior to installation.

3.02 PREPARATION

A. Visit each camera installation location to verify the type of mount prior to ordering the cameras.
B. If another contractor is installing the CAT-6 cabling then the contractor shall coordinate cable location with that contractor.
C. Green Tape walk thru.
   1. Contractor shall walk the entire site with the owner and identify each camera location with the owner prior to installation.
   2. Discuss the type of camera and its proposed field of view.
   3. Make adjustments as required by the owner and by the building structure to minimize interference and blocking of the camera image.
   4. Install a piece of green tape on the wall or ceiling at each camera location after agreement on the location is reached.
   5. Remove green tape after installation of cameras
D. Camera naming spreadsheet.
   1. Create an Excel spreadsheet showing the following:
      a. Camera number
      b. Camera part number
      c. IP address
      d. MAC address
      e. Owners chosen camera name
      f. Provide to the owner and designer.

3.03 INSTALLATION

A. Each camera shall be installed to provide maximum field of view and security.
B. Exterior cameras shall be mounted securely to the structure and shall be sealed to prevent water or any other environmental condition to enter the camera.
   1. Provide the correct mount for the location of each exterior camera.
   2. Where the mount is to the outside of a building then the contractor shall install a conduit from the exterior camera to the inside of the building for the camera cable(s).
   3. Review mounting location to determine optimum height of camera to cover all areas and provide the clearest pictures. Mount at appropriate height.

4. Work with the Owner to focus and align all cameras for maximum coverage.
5. Contractor shall change lenses for different focal lengths based on the actual installation location of the cameras and the requirements of the Owner.
6. Seal around all conduit openings and the camera mount to seal from water and air infiltration.
7. Install patch cable through the conduit and connect to the CAT-6 cable on the interior of the building.

C. Interior cameras shall be mounted in the lay-in ceiling, supported from the open ceiling or to the wall with a structural mount.
1. The Contractor shall work with the Owner to determine the location of all the cameras.
2. Work with the Owner to determine the direction of the lens and its focal length.
3. Ensure that the camera is mounted securely to the drop ceiling and is supported from the T-bar.
4. Where interior cameras are mounted to the wall, the Contractor shall provide a mount that will allow all cables to route through the mount. Cables shall not be “free-floating” from the wall to the camera.
5. When a camera is pendant mounted the contractor shall install a down-pipe and conduit support to mount the camera at the correct height as determined by the owner.

D. Camera obstructions
1. Prior to camera installation review the site and make sure to install cameras so there are no obstructions such as lights, ducts, EXIT signs etc. that will obstruct the camera view.
2. Provide additional pipe and threaded rod as required to mount camera so there is no obstruction of the view.
3. Install at height or location so that the camera sees the entire field of view.

E. Contractor shall focus and aim all cameras
1. Camera aiming and focusing shall be a process where the owner has input at each stage.
2. The process for aiming and focusing shall be as follows:
    a. Meet with the owner and determine the desired view of each camera. Determine where images shall overlap and what they are focusing etc.
        1) Add this information to the camera naming spreadsheet.
    b. Install the cameras and aim as per the meeting notes.
    c. Meet with the owner and review each camera view on the monitor. Make notes of any changes required.
    d. Schedule a time to make all changes.
        1) Changes shall be made while the owner is reviewing the live image through the VMS Software. The contractor shall have a person at the camera that can aim and focus the camera.
        2) Once the owner agrees on the image aim and focus generate a still picture of that image and keep it in a file.
        3) Print the aimed view and provide as part of the submittal at project substantial completion.

F. Camera naming
1. The contractor shall work with the owner and engineer to determine the naming and numbering convention for the cameras.
2. Determine the naming and then apply that to each camera. Enter the designation of the camera into the video security system.
3. On all cameras the contractor shall affix a label with the camera number to the exterior case of the camera. This shall be visible when standing near the camera.

END OF SECTION 28 3700

SECTION 28 5000 – AV SYSTEM INTEGRATION

PART 1 - GENERAL

1.01 WORK INCLUDED

A. This section provides direction on providing a complete Audio and Video system at the site. The contractor shall provide all equipment, cabling, configuration, testing and commissioning of the system

B. The AV system is unique and shall be configured to be such. There are many items that will require input from the owner and extensive training on how the system will operate.

C. The contractor shall provide a turnkey system as part of their bid.

PART 2 - EQUIPMENT

2.01 NONE.

PART 3 - EXECUTION

3.01 SYSTEM DESIGN

A. Provide the final design, engineering drawings and installation of the equipment, including programming, testing, training, and commissioning the system for the installation of an audiovisual system per the requirements in this and associated document. The completed system shall be completely operational and ready for the owner's use by the move-in date.

B. The scope of the contractor's services shall include, but not be limited to:

1. Final AV component selection and connectivity
2. Cable, faceplate and custom panel design
3. Overall system engineering in compliance with the performance criteria
4. Furnish and install AV system cabling for every AV device component and accessory.
5. Furnish and install the cable labeling on all AV cables.
6. AV device mounting and cable terminations
7. System testing
8. User manuals
9. Project management
10. System configuration
11. Demonstration and training to owner (as required)
12. As-built engineered drawings
13. System warranty

C. Audio Visual Contractor (AVC)— design responsibility:

1. The audio-visual equipment specifications provided in this document is intended to outline the major A/V system features, control methods and minimum overall system function. The equipment list is not intended to be a final list of component selection, point-to-point wiring, in/out flow diagrams, control panel layouts, etc.

D. Supplemental equipment: the AVC shall furnish and install all video switchers, distribution amplifiers. cabling, source amplification, controls, voltage transformation devices, surge protection equipment, cabling, termination jacks, face plates, labeling, etc. As required for a complete and operational audio visual system.

3.02 TOUCHPANEL

A. Provide and install a touchpanel as shown on the drawings

B. Connect the tocuchpanel to the Ethernet network

C. Work with the owner on configuration of the touchpanel

D. Copy touchpanel layout to the owners network login

E. Work with the owner on symbols, start page, reset button, volume control, video routing etc on the touchpanel layout

F. Create a layout with start page

G. Create a layout for audio control
H. Create a layout for video control
I. When system turns all equipment shall reset to standard levels.
J. Demonstrate to the owner the touchpanel. Take their input and change and update the touchpanel and control system to meet their needs.

3.03 SYSTEM DESIGN FOR SYSTEMS WITH A CONTROL SYSTEM

A. Systems with a control system shall require additional planning and coordination.
   1. Provide a complete system and connection of control cables for each device
   2. Control system design, connectivity and touchpanel interfaces shall be fully designed
   3. The AVC is responsible for including IP-based control functionality. All control system touch screen functions shall have the capability to be controlled via a web page on Internet Explorer.
      a. The web pages shall be a duplication of the look and function of each rooms touch panel screen layouts. This set-up and page loading shall be the responsibility of the AVC. This functionality is required for all AV rooms with automated touch panel OR button panel control
      b. Design all interface panels and get those approved by designer and owner piror to configuration
   4. Provide all interfaces, expansion modules, software, cabling and IR and RS-232 devices required to control all devices.
B. Systems with button controllers
   1. Meet with the owner to understand what functions are required of the button panel.
   2. Provide and install labeled buttons that correspond with their work. Verify that with the owner prior to ordering or installing.
   3. Configure the button controller to fully control all components required and as shown on the drawings.
   4. Connect the button panel directly to devices or to control devices.
   5. Create a button panel and provide to the owner and designer for approval prior to installing.

3.04 GENERAL REQUIREMENTS

A. Discontinued equipment: at time of bid, the AVC must confirm that the proposed products are currently available for purchase and have not been discontinued. Change orders will not be accepted for any additional costs incurred to replace a discontinued product. Include in your RFP response statement confirming product availability and any time frame that may impact product availability.
B. The AVC shall be responsible for obtaining a low voltage installation permit and city installer license (if required) at no additional cost.
C. The AVC is required to cover all exposed AV cabling with a nylon mesh material within user space areas, conference rooms and rack areas.
D. The AVC shall copy the designer on all correspondence with the owner and other contractors throughout the project

3.05 PROJECT SPECIFIC EQUIPMENT REQUIREMENTS

A. Provide fixed audio/visual system design and installation that will provide presentation capabilities. The audio/visual contractor (AVC) will be responsible for final design, installation, system configuration, testing and demonstration of the completed system by the completion date.
B. LCD displays

1. LCD monitor location: the AVC shall be responsible for the final location of the LCD displays.
2. The AVC is responsible for mounting the LCD monitor onto the LCD wall brackets. LCD wall brackets shall be furnished by AVC, and are to be installed by the AVC.

C. Speakers
1. In drop ceilings provide a tile bridge for speakers
2. In open ceilings and drywall ceilings provide a backbox for all speakers. Route the cabling into the backbox.
3. In open ceilings provide structural steel and unistrut and unique hardware required to mount and aim the speakers.
4. Provide all manufacturer recommended accessories and hardware to mount and aim the speakers to cover audio for the entire room/space.

D. Cabling / support: AV system cabling shall be plenum rated when installed through a ceiling area.
1. Any cabling installed underground shall be underground rated.

E. The AVC shall be responsible for turning all equipment manufacturer remotes over to the owner. This includes any remote that may not be needed because there is a control system. These remotes shall be in the rack drawer or near the AV equipment. The remote control shall be in the same room as the equipment it needs to control is in.

F. Room readiness: the owner/GC will make every effort to prepare the AV rooms for the AVC's installation. Completion scheduling for the delivery of key tables, furniture and cabling must be coordinated and identified by the AVC.
1. If the owner or GC cannot deliver these items per the agreed upon dates, the AVC shall be required to re-schedule their man power to be on site only after that delivery is complete.
a. There shall be no additional cost to the owner to make these scheduling adjustments unless overtime is required and authorized in writing by the owner.

3.06 PROJECT MANAGEMENT

A. Project management: the successful contractor shall commit to providing a single project manager for this project. This project manager shall be responsible of the following:
1. Participate in the development of a project plan for scheduling and coordination tasks with the general and electrical contractors related to the AV system.
2. Attendance of project coordination meetings as required, up to 1-per week over the duration of the construction phase of the project.
3. Tracking and identifying tasks via a project schedule that is put together by the AVC for review/approval by engineer and owner. Refer to tasks below that are required to be included in the project schedule.
4. Tracking and identifying critical project phasing and delivery time sensitive issues related to the installation of the AV system. Tasks to be tracked shall include but not limited to the following:
a. Equipment procurement
b. Cut sheet submittals
c. System drawing submittals
d. Custom panel and custom plate diagrams and approvals
e. Control system Touch panel layout submittals
f. Pre-installation
g. System test in shop
h. Remaining equipment delivery

i. Field installation
j. AVC system test/commission
k. Engineer demonstration
l. Owner training
m. Owner sign off/acceptance
n. As-built drawings
o. Operation manuals/control button code turn over
p. Coordination with the other contractors for equipment delivery and completion of AV installation tasks is to be included in the project schedule and critical to completion of the project.

B. Five (5) weeks prior to substantial completion, the AVC shall identify what external services need to be provided by the owner for AV system testing.
C. The AVC's design scheme shall include HDMI cable equalizers for all HDMI cable lengths where the distance exceeds 35 feel. Verify all final HDMI cable lengths in the field prior to purchase and include the HDMI cable equalizer if required.
D. The AVC'S design scheme shall not include running unbalanced audio over 15 feet, it is the AVC'S responsibility to provide adequate signal adapters / converters to maintain proper audio signal over a 15 foot distance. AVC is required to provide a balanced audio signal for these distances.
E. The AVC is required to lock-out or block inputs that are not being utilized on a monitor, the AVC is required to go into the menu and blank out the inputs that are not being used.
F. The AVC is required to label the inputs on the monitors so the end—user understands what the inputs relate to.

3.07 RACK REQUIREMENTS

A. The AVC is required to provide all rack/cabinet mounting hardware for all source equipment. This includes any shelves for mounting equipment.
B. UL listed cords and power strips are required for all rack and equipment power.
C. The AVC is required to provide all interconnect cabling between the rack devices and components.

3.08 CABLING REQUIREMENTS

A. The AVC shall finish and install the appropriate low voltage AV signal cabling as required for proper operation of the AV system components.
B. It is the responsibility of the AV contractor to verify the site conditions and lengths that may impact operations of the components prior to final low voltage signaling cable selection and installation.
C. It is the responsibility of the AV contractor to coordinate with the product manufacturer's technical specifications and support for any specific low voltage signaling cable criteria (length, type, manufacturer or model number) that may be unique to that product vendor.
    1. Should a vendor require a cable type other than what is specified, the AVC must identify that issue to the engineer and owner and general contractor prior to the purchase and installation of the low voltage AV signaling cable.
D. The AVC must identify in writing any field conditions that warrant a review and confirmation of the low voltage AV cabling system.
E. The AVC is required to meet regularly with the Electrical and Low voltage cable installer to give them site specific direction on what cable starts and ends where, routing and length limitations and to assess any field conditions that would warrant a change in the pathways routing conditions for a fully operational AV system.

F. Slack cable: the AV low voltage signal cable must be provided with adequate slack for final termination or re-termination by the AVC at the time of AV rack/device placement. The cable installer is required to provide a minimum of 36-inches of slack cable look coiled and managed for final device and rack installation.

3.09 MISCELLANEOUS REQUIREMENTS

A. Any unused knob or dial on any device equipment is required to be labeled as ‘un—used’ with a large clear adhesive label

B. Label any AV device that the end-user will interface with (i.e.: handheld microphone, lapel microphone, rack equipment, input connector, etc.

C. Substitution of AV equipment is acceptable with the following conditions:

1. Substitute equipment performance parameters meet or exceed all parameters of the specified equipment.
2. Substitute equipment manufacturer has been in the business of manufacturing that specific product line for a minimum of 3-years.
3. Submit equipment substitute cut sheets with the proposal

3.10 ITEMS PROVIDED BY OTHERS:

A. Owner:

1. Audio-visual system administrator: an owner employee must be designated as the audio-visual administrator and will be available to the audio-visual contractor for specific configuration issues and for final system training.
2. An owner employee, from the IT staff shall assist the audio—visual contractor with network connectivity and any other related IT issues.
3. IP addresses: an owner employee will be designated to provide these addresses for the associated AV devices.
4. TV service connectivity: an owner employee will be designated for confirming the TV distribution system.

B. By the electrical contractor:

1. Power to racks and power to displays.

END OF SECTION 28 5000

SECTION 28 5350 – CLASSROOM AUDIO

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. This section provides specific project and Contractor requirements for audio systems in the classrooms and other general spaces

B. Parts and labor required for installation and testing of classroom audio and video components and cabling.

1.02 COORDINATION

A. Coordinate the location of all speakers and the projector with the existing equipment in the ceiling. Take into account the lights and the other equipment when locating the speakers. Meet with the owner or their representative on placement of equipment in each room prior to installation.

B. Speakers shall be installed in the ceiling to cover the most area. Speakers shall not be mounted to the outside edge of the room or near the edge of the room.

PART 2 - PRODUCTS

2.01 MATERIALS

A. The contractor shall provide equipment as required for a complete audio/video classroom teaching installation.

B. Any and all baluns, patch cords, interface cords splitters and other equipment shall be provided and installed to provide complete connectivity.

2.02 CLASSROOM AUDIO COMBO MIC AND AMPLIFIER SYSTEM

A. The system must have specifications including but not limited to the following:
   1. Access (1.9GHz DECT Type) Technology wireless communication
   2. Wireless transmission range: up to 200 ft. (600m) open field
   3. Up to two microphones for whole room instruction, team-teaching or student sharing.
      a. Equip with one (1) microphone and neck lanyard.
   4. Pendant-style classroom microphone with audio input utilizing Access Technology (1.9 GHz) for transmission.
   5. Three (3) stereo audio inputs with master volume control
   6. One line level audio output with level control
   7. Two speaker outputs to power a total of 1-4 speakers

B. The system shall carry a standard warranty equivalent from the manufacturer of no less than 3-years.

C. Amplifier/mixer
   1. Wireless communication: Access (DECT Type) Technology
   2. Wireless transmission range: up to 200 ft (60m) open field
   3. Power output: 40 Watts Total (20 W / Channel)
   4. Frequency response: 20 Hz to 20 kHz amplifier
   5. Automatic power on when Microphone is powered on and linked
   6. Controls:
      a. (1) Power button
      b. (1) Microphone volume control
      c. (1) Audio input volume controls
      d. (1) Audio output level control
      e. Tone control

D. Pendant-Style Microphone and transmitter

1. The pendant-style microphone/transmitter shall contain microphone volume control on the unit allowing users to adjust volume level from anywhere in the classroom.
2. Shall be capable of being worn around a teacher's neck as a hands-free microphone via the lavaliere cord (provided by contractor) or to be used as a handheld student pass-around microphone.
3. Must be rechargeable via wall charger, computer, or Charging Station
4. Lanyard: adjustable length with magnetic clasp
5. Wireless communication: Access (Dect) Technology
6. Transmission range: up to 200 ft (60m)
7. Integrated microphone type: uni-directional electret
8. Audio input: 3.5mm
9. Earbud output: 3.5mm
10. Volume control: +/- 6dB (total range = 12 dB)
11. Power: on/off/mute button
12. Battery run time: 8 hours (fully charged)

E. Audio System Shall be Lightspeed #Cascadia T25 or equal.
1. Equip with one Lightspeed Clearmike or equal
2. Equip with Clearmike Charging cradle and adjustable lanyard

2.03 AUDIO SPEAKERS

A. The Contractor shall conduct a field evaluation of each classroom prior to ordering the equipment and shall order and install the correct type of speakers based on the actual ceiling in each classroom Select one speaker choice from below:

B. Drop Ceiling Speakers
1. Ceiling Speaker (Provide four in each classroom)
a. Two-way speaker system
b. Driver Size: 6.5" driver; 1" tweeter
c. Frequency Response: 40 Hz – 20 kHz ± 6dB
d. Impedance: 8 Ω with Power Handling: 30 W
e. Tile Support: 20-gauge metal tile bridge
f. Lightspeed #DRQ or equal.

C. Open Ceiling or Wall mount Speaker
1. Open Ceiling Speaker -wall or surface mounted.
a. Description: two-way speaker system
b. Driver Size: 4" with 1" tweeter
c. Frequency Response: 60 Hz – 20 kHz ± 6dB
d. Impedance: 8 Ω
e. Power Handling: 30 W
f. Enclosure: white ABS enclosure with steel mesh grille
g. Lightspeed # WMQ or equal

PART 3 - EXECUTION

3.01 EXAMINATION

A. Location of the audio components shall be finalized in each classroom prior to installation beginning.

3.02 PREPARATION

A. The contractor shall meet with the owner to determine the installation schedule for the project. The owner will provide the contractor with dates when work can be completed in each building.

B. Coordinate with the electrical contractor to ensure that they install the power outlet in the ceiling at the projector mount. This shall be identified in each room prior to installation.

3.03 SITE REVIEW AND PLANNING

A. Classrooms have drop ceilings or open ceilings. Install the correct speaker type based on the ceiling of each room.

B. All speaker cables shall route back to the teacher faceplate.

C. The contractor shall visit each classroom where the Audio/Video systems are to be installed and shall also note any potential issues in each classroom that might impede the installation of the audio/video components.

3.04 AUDIO ELECTRONICS INSTALLATION

A. The audio system shall be installed at the location shown on the drawings.

B. The system includes cabling, speakers, microphone and the mixer/amplifier,

C. Review the layout of the room and the existing lights and other items in the ceiling. Locate the speakers to provide the best coverage of the room with audio.

D. Speaker cables shall be connected in series. One cable shall be used to connect the mixer/amplifier to the first speaker and then to the other speakers as per the drawing. Contact the manufacturer with questions about speaker and speaker cable connectivity.

E. Connect speaker wires and all audio inputs to the mixer/amplifier. Adjust all inputs, outputs and audio controls to provide even sound between each input. Tune the system to provide clear audio without feedback. Speakers shall be placed with the idea of limiting feedback.

F. When connecting speakers to the amplifiers, ensure the correct polarity throughout the system.

G. Contractor shall label the volume control for each input. Labels shall be self-adhesive and shall be laser printed. Provide a sample label to the owner for approval prior to installation... All labels shall specify the device that dial controls. Handwritten labels are not allowed.

H. After connection of the system, the Contractor shall configure all components to ensure the best sound possible.

I. Contractor shall test each and every input and output of the system. Contractor shall have the Owner present for final testing and system checkout.

J. Connect the control system to the main output of the amplifier.

K. Mark the mixer for the optimal level and location each level control.

3.05 SPEAKER INSTALLATION

A. Prior to ordering all speakers, field verify the ceiling type in each classroom. Order the correct speakers for drop ceiling rooms and hard ceiling rooms etc.

1. Review ceiling types on architectural drawings or walk the site if the building is existing.

B. Ceiling speakers shall be mounted flush with the ceiling.

1. Ceiling speakers shall be installed into the existing ceiling tiles. Contractor shall cut each ceiling tile and install the speaker with the tile bridge.
2. Contractor shall work with the Owner to locate all speakers where other equipment will not impede the installation.
3. Where the manufacturer provides a T-bar support for the speaker, the Contractor shall install the support in drop ceiling installations.
4. Speaker wire shall not lie on the ceiling. All speaker wire shall route through J-hooks.
5. The Contractor shall leave a coil of speaker wire in the ceiling to allow lowering of the speaker for maintenance and removal.
6. The Contractor shall work with the manufacturer to determine the best layout of the speakers, and shall submit that layout for review prior to installation.

7. After installation, the entire system shall be tested, and it shall be demonstrated that each speaker is connected and in good working order.
8. It shall be further demonstrated that all audio can be easily heard throughout each room where speakers have been installed.

C. Surface speakers shall be mounted to the building structure and aimed to cover the room.
1. Contractor shall work with the Owner to locate all speakers where other equipment will not impede the installation.
2. Speaker wire shall not lie on the ceiling. All speaker wire shall route through J-hooks.
3. The Contractor shall leave a coil of speaker wire in the ceiling to allow lowering of the speaker for maintenance and removal.
4. The Contractor shall work with the manufacturer to determine the best layout of the speakers, and shall submit that layout for review prior to installation.
5. After installation, the entire system shall be tested, and it shall be demonstrated that each speaker is connected and in good working order.
6. It shall be further demonstrated that all audio can be easily heard throughout each room where speakers have been installed.

3.06 MICROPHONE INSTALLATION

A. Wireless microphones shall be installed to serve the entire room areas where they are installed.
1. Locate the antennae for all wireless microphones so that the signal will be picked up from anywhere in the room that the microphone serves.
2. Coordinate all outside and interior signals with any wireless microphone channels so that there is no interference.
3. Connect the wireless microphone base receiver to the input on the amplifier/mixer.

3.07 AUDIO SYSTEM

A. The entire audio systems shall be configured to be a complete working system.

B. The Contractor shall label each speaker cable at each end with a wraparound label that has been laser printed.
1. The Contractor shall give each speaker wire a separate designator. The Engineer shall approve the proposed numbering prior to printing the labels.

C. Each component shall be labeled for what it does and what it provides. Labels shall be laser printed, and shall be attached to the front of each unit.
1. For example, the amplifier in a cabinet may be marked “Microphone Amplifier-First Floor Hallway.”

D. It is extremely important that each microphone cable be labeled at each end with a laser printed wrap around label. This will allow the Owner to know exactly which microphone is being connected.
1. Where microphones are terminated, the Contractor shall provide a minimum of 3 feet of spare cable for future movements.
2. The Contractor shall provide the proposed labeling of the microphone cables prior to the actual installation of the labels.

E. All speakers shall be set so that every area in the room where persons may stand or sit is covered with sound.

END OF SECTION 28 5350

SECTION 28 5400 – VIDEO EQUIPMENT

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Parts and equipment required for transmitting, switching, generating and viewing video images.

1.02 SYSTEM DESCRIPTION

A. The video systems shall be installed to provide the easiest user interface possible.

B. Cover boxes that are used to feed displays with the actual lcd.

1.03 COORDINATION

A. Coordinate the location of all LCD Displays, and projectors with the Owner and other trades prior to final installation.

B. Coordinate with other Contractors who are doing work in the ceiling space. Coordinate the installation of all cables, projectors, monitors, etc., with the locations of other services.

C. Work with electrician to verify they are installing raceways to service your cabling and equipment.

1. If you do not coordinate these raceways prior to their raceway installation then new raceways will be the responsibility of the technolog contractor who is installing those cables.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Approved manufacturers of specialized video transmission, switching, and scaling equipment are:

1. Extron.
2. Kramer.
3. Tripp Lite
4. Key Digital.
5. Visionary solutions
6. QSC
7. Tascam
8. Logitech
9. Tripp Lite
10. Others as noted in these specifications

2.02 HDMI DISTRIBUTION AMPLIFIER

A. HDMI Distribution Amplifier,

1. Shall have one HDMI input and multiple outputs. 4K Compatible
2. Shall support. Ultra HD/4K Support: 4096x2160 or 3840x2160 24/25/30/60hz at 4:4:4 (signals up to 18Gbps bandwidth)
3. Shall be e HDMI 2.0 compatible. HDCP 2.2 Compliant
4. Output shall be HDMI type A connector
5. Shall be HDCP Compliant.
6. Provide all patch cables required to connect this to the display device.
7. 1-in, 4-out Distribution Amplifier shall be Key digital #KD-DA1x4X or equal

2.03 HDMI TO UTP TRANSCEIVERS

A. HDMI to UTP device Shall include USB-C input

B. See drawings for part number.

C. Provide and install cabling to support the transfer of the video signal from the faceplate to the receiving unit.

D. Mount receiving unit to back of LCD.

E. Setup to support HDMI first and then to switch to USB-c When connected to a video signal

2.04 IP NETWORK DEVICES

A. IP based encoder and decoder with controls and i/o ports -Multiple input/output
   1. The network video endpoint shall be a component in a distribution system that routes 4K60 4:4:4 video over a Gigabit Ethernet network.
      a. Shall be rack mounted.
      b. It shall use data compression to ensure highest quality with very low latency.
      c. Shall act as an encoder and decoder and shall route audio/video/controls and contact closures.
      d. IP endpoint shall include:
         1) Three HDMI 2.0 Inputs
         2) Two HDMI 2.0 outputs and shall be fully compliant with HDCP 1.4 and 2.2.
         3) Shall also have an RJ45 network port with Power over Ethernet (802.3bt) compatibility
         4) 3.5mm audio input-Stereo
         5) 3.5mm audio output-Stereo
         6) Quad USB type A for Audio
         7) Single USB type B for Conferencing connectivity.
         8) RS-232 control output.
      e. The network video endpoint shall natively route audio data through a network
      f. The network video endpoint shall be powered by a 48-volt external power supply or through the network port using Power over Ethernet.
      g. The network video endpoint shall be the Q-SYS #NV-32-H.

B. IP based encoder and decoder with controls and i/o ports -Single input/output
   1. Shall have one HDMI 2.0 input, one USB-C input, and one HDMI 2.0 output.
   2. The endpoint must support video distribution for formats up to 3840x2160p60 4:4:4 from both HDMI and USB-C inputs.
   3. The USB-C input of the network video endpoint shall support a single connection for audio and video distribution through USB-C alt-mode DisplayPort, bridging audio and video signals to an application on the host via UAC/UVC, and USB-C PD (power delivery) of up to 65 Watts shall be available for device charging.
   4. The endpoint shall support Consumer Electronic Control (CEC) of connected devices on the HDMI Output. The endpoint shall support USB HID signal routing between hosts and devices.
   5. The network video endpoint shall be user configurable to be either a transmitter (encoder) or receiver (decoder).
   6. The HDMI 2.0 output must scale incoming content from the network and local input connections.
   7. The endpoint shall be powered by an external 12V DC 9 A auxiliary power supply or via PoE Type 3, Class 5 (40w at PD, 45W at PSE) from a capable network switch or midspan injector. It is acceptable for an auxiliary power supply to be required if device charging is needed.
   8. The network video endpoint shall operate natively on a standard gigabit Ethernet infrastructure available from a broad range of network infrastructure manufacturers, employing DiffServe quality of service (QoS), IGMP, IEEE 1588-2008 (PTPv2) precision time protocol, UDP/IP audio, and video transport with floating point format

audio data representation. The endpoint shall support 802.1x authentication. The endpoint shall communicate with the system audio processor without needing AES67, Dante, or Media Stream receiver components.

9. The network video endpoint shall be the Q-SYS NV-21-HU or equal.

C. Ethernet Switch
1. Provide a rack mounted Ethernet switch in the audio/video system that supports routing and distribution of Audio and Video Signals throughout the system.
2. Switch shall be:
a. Rack mounted and powered from 120 volt power
b. Capable of PoE+ output for most ports
c. Equipped with a power supply to support PoE+
d. Equipped to support Dante Digital Audio distribution
e. Video over IP Signal distribution
3. Ethernet switch shall be QSYS. Provide and install switch to support all inputs.

2.05 MISCELLANEUOUS DEVICES

A. Rack Mount Shelf for mounting the AV equipment shall be installed where shown.
1. The shelf shall be equipped for supporting all AV equipment.
2. Shelf shall be deep enough to support all equipment
3. Shelf shall be Middle Atlantic #UFA-8-4 or equal. Equip with coverplate #UFAF-1

PART 3 - EXECUTION

3.01 EXAMINATION

A. Location of the video mounts shall be finalized throughout the building prior to installation.
B. Locate all equipment to be installed, and make certain that space is available for maintenance and service during the life of the system.
C. If any changes from the drawings are required, the Contractor shall submit a proposed layout of the displays to the Engineer for approval prior to installation.

3.02 PREPARATION

A. Ensure that the wall where a display will be mounted can support the weight of the mount and the display.
B. Coordinate with the Lighting Contractor on location of all displays. Ensure that lighting will not impede the viewing of the image.
C. Coordination with other Trades:
1. The Contractor shall meet with the Electrical Contractor prior to installation of the security conduits and boxes to ensure that the boxes to be installed by the Electrical Contractor meet the requirements of the security camera system.
2. Coordinate power requirements in the communications room with other trades that will be installing equipment in the communications room.
3. It is the responsibility of the Contractor to install additional pass-thru’s if required for the installation of their work. Fire-stop each pass-thru according to code requirements.

3.03 GENERAL VIDEO INSTALLATION

A. The entire video system shall be configured to be a complete working system.
1. Each cable shall pass the required video and audio signals.
2. Each display device shall be fully connected to all inputs and control cables.
3. Each display and signal processor and video source shall be set to maximize the video transmission and image quality so that they match the resolution.
4. Test each input on each display.
B. Provide all hardware and installation materials to support the video display devices.

1. Install custom unistrut and custom threaded rod from building structure to support all display devices and projection screens.

C. Each component shall be labeled for what it does and what it provides. Labels shall be laser-printed, and shall be attached to the front of each unit.

D. Projector and LCD Display mounts:
1. Each display that is to be ceiling or wall mounted shall have a UL listed mount.
2. Contractor shall match the display with the manufacturers recommended mount.
3. Verify that the mount is rated to support the weight of the display.
4. Install all mounts so that the display is not located in a main traffic way where persons might injure themselves by running into the mount or display.
5. Ensure that the mount can support the weight of the display, and that the wall can support the combined weight of the display and the mount. Secure to the wall using appropriate supporting screws and lugs.
6. Where attaching to a drywall wall, attach through or into the stud and not just through the drywall.
7. When ceiling mounting a projector or LCD, provide the required length of pipe extension to meet the desired height of the display.
8. Contractor shall ensure the safety of all persons by securely installing the correct mounts for each display or projector.

3.04 AV EQUIPMENT INSTALLATION

A. USB Extender
1. Use this to transmit the USB signal farther than on standard USB cable.
2. Connect with patch cables at the projector/interactive white board to the CAT-6 jack in the faceplate.
3. Connect output of PC to the other USB to UTP unit. Install patch cable to the faceplate near the PC.

B. UTP audio and video transmitters and receivers.
1. The UTP devices shall be used to transmit the signals for the various displays.
2. Install all cables required to transmit signals from source to display output. Provide all patch cables for complete connectivity.
3. The transmitter shall be connected to the source device as shown on the drawings. The contractor shall make all audio and video connections.
4. At each display the contractor shall configure the receiver to compensate for any skew of the signal.
5. Connect the audio and video outputs of the receivers to the video displays.

C. Distribution Amplifiers
1. All distribution amplifiers shall accept the input and multiply that to two or more identical outputs.
2. Provide all cables and adapters required to connect each device to the input and output of the distribution amplifiers.
3. Label the input and output of each DA for the device to which it connects.
4. Where DA’s and amplifiers are installed below a desk or table they shall be attached to that table and out of the knee space.

D. Control Panel.
1. The control panel shall be installed as shown on the drawings. Provide all the appropriate push buttons in the plate.
2. Meet with the owner to determine the sequence of how the control panel should work and what it shall control.

3. Install all cabling and sensors/devices required to transmit the signal and control the devices that are to be connected.

3.05 IP AV ETHERNET NETWORK AND EQUIPMENT CONFIGURATION

A. The Contractor shall configure and install the Ethernet Switches that serve the AV system and all attached AV devices as per the detailed specifications and the configuration meetings with the Owner.
   1. Meetings shall be scheduled with the Owner to discuss the configurations of all electronics and the capabilities of the system.
   2. From the meetings, the owner and contractor shall generate a plan for all configuration issues of the AV Ethernet netowrk including but not limited to:
      a. IP Numbering Scheme
      b. VLAN settings
      c. Quality of Service (QoS) settings
      d. Network Prioritization
      e. Wireless connectivity for PC's integrating with the AV devices.

B. The owner shall be able to be involved in all aspects of the configuration.

C. The network electronics shall be configured with complex authentication credentials (passwords).

D. The network electronics shall NOT be configured with default usernames, default passwords or default SNMP community strings.

E. The network electronics shall be configured to synchronize internal clocks to a designated internal NTP server.

F. The network electronics shall be configured with the same time zone settings and said time zone shall be the local time zone in Michigan.

G. Setup the system to support and segment Bonjour (Apple TV) traffic to ensure transmission of the video information.

H. Label all Ethernet switches with the IP address and Switch name.

I. Provide to the owner all passwords.

3.06 TESTING (PRE-COMMISSIONING)

A. All systems shall be initially adjusted and set by the contractor, unless otherwise specified, in writing, by the Consultant or the architect.

B. A complete mechanical and electronic inspection to verify proper installation and operation shall be made, including mountings, interconnection, video scaling and sizing. Test procedures and documentation of results shall be provided with the system documentation.

C. procedures and documentation of results shall be provided with the system documentation.

3.07 COMMISSIONING

A. The video Contractor will provide a technician to assist the Consultant during the commissioning of the system. The technician will be ready and available to make any necessary adjustments or repairs to the system that the Consultant finds in error of the specification.

B. The Video Contractor will have on hand all installation documentation and equipment manuals. The Contractor will have the necessary tools available for any adjustment or repairs. Once the system is commissioned, the Contractor will provide final As-built documents to the Consultant for review.

END OF SECTION 28 5400

SECTION 28 5401 – FLAT PANEL VIDEO DISPLAYS

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Parts and equipment required for transmitting, switching, generating and viewing video images.

B. The words LCD, Display and Flat Panel display shall be used interchangeably and shall refer to a flat panel display that has LED or OLED lighting or is a direct view LED display.

1.02 SYSTEM DESCRIPTION

A. Each LCD Display, or projector shall be installed so that users can easily view the picture being presented.

B. The video systems shall be installed to provide the easiest user interface possible.

1.03 COORDINATION

A. Coordinate the location of all LCD Displays, and projectors with the Owner and other trades prior to final installation.

B. Coordinate with other Contractors who are doing work in the ceiling space. Coordinate the installation of all cables, projectors, monitors, etc., with the locations of other services.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Approved vendors for video displays are:
1. Samsung
2. Panasonic
3. LG
4. Epson
5. NEC

2.02 LCD DISPLAYS

A. LCD Display -450+cd/M (NIT Brightness)
1. Specified for 18/7 runtime
2. Displays shall be 16:9 and shall include speakers
3. Display shall be an LCD screen with LED backlight
   a. Minimum 350 cd/M²
4. Display shall be able to show images at 480i, 480p, 720p and 1080p and 4K
   a. Minimum pixels of 3840x2160
5. Inputs shall be a minimum of:
   a. HDMI x3
   b. USB-C x1
   c. Ethernet LAN 1000MB
   d. USB-A x3 1 for Downstream, 2 for Media/Peripherals
6. Outputs shall be a minimum of:
   a. Optical Audio out
   b. 3.5mm audio
7. Control
   a. Shall have an RS-232 and IR. Each display shall include a remote control.
8. Speakers.
   a. Shall be two speaker with minimum 10 Watts each.
9. Shall have Wireless LAN Connectivity
10. When using a 3rd party control system, the contractor shall provide and install the connectors and cabling required for RS-232 control.
11. Displays capable of 4K shall be
   a. 65” LCD Display UHD shall be SHARP #PN-ME652 or equal

B. LCD Touch panel. Interactive display
1. LCD Display shall be installed as shown on the drawings.
2. Displays shall be 16:9 and shall include speakers
   a. Speakers shall be 25 watt
3. Display shall be an LCD screen
4. Display shall be 3840 x 2160

5. Video/audio input shall be a minimum of:
    a. Front side:
        1) HDMI in
        2) 1-USB-A Touch
        3) 2-USB-C 3.2
        4) 1-Mic In
    b. Rear side:
        1) 2-HDMI In
        2) 1-USB-C
        3) 1-USB-C Video out
        4) 2-USB-A
        5) 3 USB-A Touch
        6) 1-HDMI Out
        7) 1-S.PDIF Out
        8) 1- Line Out
        9) 1-RS-232
        10) 1 LAN In
        11) 1 LAN Out
6. Control
    a. Shall have an RS-232 input/output for control.
    b. Shall be equipped with Ethernet 10/100Mbps connection
    c. USB for connection of interactive PC
7. Equipped with VESA compatible mounting holes
8. Display shall be no thicker than 4-1/2 inches.
9. Each display shall include a remote control.
10. Shall include WIFI Module
11. Display shall be an interactive touch panel that includes at a minimum:
    a. Shall work with Windows PC's and Apple IOS an Android 15
    b. Touch technology shall be IR Blocking or equal
    c. Shall allow up to 50 points of contact
    d. Shall be adaptive to work with finger touch or mfg. pens
    e. Include interactive software that on the display and that can be loaded on the PC or Apple device
12. Touch panel display shall be NEWLINE. Include minimum 3-year manufacturer warranty
    a. 65" Diagonal shall be Newline #TT-6525QELT
    b. 86" Diagonal shall be Newline #TT-8625QELT

2.03 FLAT PANEL MOUNTS

A. Flat panel Mounts
1. All supports for LCD panels and monitors shall be appropriately sized and chosen for the exact model display to be supported.
2. Contractor shall match the weight of the display to the recommended weight rating of the support.
3. Contractor shall review the location where the support is to be mounted. Match the surface to which the display is to be mounted with the best attachment hardware available for the support.
4. All supports shall be by Chief Corporation or equal. Contractor shall submit each support for review by the Owner and Engineer prior to installation.
    a. Wall Mount swing-out mount shall be
        1) Chief #TS318U or
        2) Chief #TS325T or
        3) Chief #TS525T or
        4) Chief #PNRUB

5) Install based on manufacturers recommendations, based on size of Display.

b. Wall mount Tilting mount shall be
1) Chief Mfg. #MTM1U for medium displays
2) Chief Mfg. #LTM1U for large displays
3) Chief Mfg. #XTM1U for extra-large displays
4) Install based on manufacturers recommendations, based on size of Display.

5. Flat Panel Ceiling Mount
a. Ceiling mounts shall be installed where specified or where there is no room on the wall for support of the LCD display
b. Provide and install all unistrut and miscellaneous hardware required to mount the display
c. Provide the correct length downpipe to mount the displays at ADA heights.
d. Equip with ceiling adapter for connection to the building structure
e. Ceiling Mount for back of LCD shall be Chief #LCM1U or equal.
f. Equip with ceiling plate Chief Mfg. #CMA101 or equal
g. Downpipe shall be custom measured length. Chief Mfg. #CMS style

6. Flat Panel Ceiling mount, Multiple Flat Panels
a. Install a mount for multiple flat panels where shown.
b. Equip with mounts compatible with the flat panels's and the multi-mount
c. Shall be UL Listed
d. Black in color
e. Tilt of 5-20 degrees
f. Shall support LCD's from 32" to 65"
g. Equip with a ceiling adapter and a custom length downpipe.
h. Equip with safety straps to the ceiling for added safety
i. Shall be Chief #LCB series with Ceiling adapter for concrete ceiling or joist support. Inspect location prior to ordering.

7. Flat panels rolling mount.
a. The rolling mount shall be able to support a flat panel and associated PC and shelf.
b. Rolling mount shall be equipped with casters.
c. Mount shall be able to support up to a 86" LCD.
d. Mount shall be Chief #PFCUB or equal.

B. Flat Panel accessories.
1. Component Storage Panel behind display
a. At each display where there are devices to be installed behind the flat panel display, install a component storage panel.
b. Hide panel and all components behind the display.
c. Shall be Chief #CSMP0X12 or equal.

2.04 HDMI TO UTP TRANSCEIVERS

A. HDMI and USB-C to UTP transmitter and receiver. Includes USB-C
1. Systems shall transmit HDMI 2.0 and USB 2.0 via CAT-6A cable.
2. Supports distances of up to 230 ft (70 m) for 1080p output or up to 130 ft (40 m) for 4K60Hz HDMI and 4K30Hz USB output.
3. Shall be HDCP 2.2 compliance ensures secure connections between source and display.
4. Transmitter shall support HDMI and USB-C input on a faceplate for single-gang backbox

a. Shall include an input choice button on the plate
b. USB-C port shall support 4K 30Hz video transmission via DP Alt Mode (v1.2a) and USB 2.0 data transfer

5. Shall support bi-directional RS-232 via Captive Screw connector
6. Receiver shall be mounted behind the display and shall support
7. Two (2) USB-A ports with up to 5V/1.4A output, accommodating high-bandwidth devices like cameras.
8. HDBase-T shall be via RJ-45 at faceplate and receiver.
9. Install plenum rated, CAT-6A cable to connect between transmitter and receiver
10. Power transmitter from the display end



11.
12. HDBaseT Extender faceplate and receiver shall be C2G # C2G31029 or equal

PART 3 - EXECUTION

3.01 EXAMINATION

A. Location of the video mounts shall be finalized throughout the building prior to installation.
B. Locate all equipment to be installed and make certain that space is available for maintenance and service during the life of the system.
C. If any changes from the drawings are required, the Contractor shall submit a proposed layout of the displays to the Engineer for approval prior to installation.

3.02 PREPARATION

A. Ensure that the wall where a display will be mounted can support the weight of the mount and the display.
   1. Work with other contractors to ensure they are installing Blocking in the walls for the LCD's
   2. Where no blocking is available, provide and install metal stud anchor kits from display mount contractor.
B. Coordinate with the Lighting Contractor on location of all displays. Ensure that lighting will not impede the viewing of the image.
C. Coordination with other Trades:
   1. The Contractor shall meet with the Electrical Contractor prior to installation of the security conduits and boxes to ensure that the boxes to be installed by the Electrical Contractor meet the requirements of the security camera system.
   2. Coordinate power requirements in the communications room with other trades that will be installing equipment in the communications room.
   3. It is the responsibility of the Contractor to install additional pass-thru's if required for the installation of their work. Fire-stop each pass-thru according to code requirements.

3.03 GENERAL VIDEO INSTALLATION

A. The entire video system shall be configured to be a complete working system.
   1. Each cable shall pass the required video and audio signals.
   2. Each display device shall be fully connected to all inputs and control cables.

3. Each display and signal processor and video source shall be set to maximize the video transmission and image quality so that they match the resolution.
4. Test each input on each display.

B. Provide all hardware and installation materials to support the video display devices.
1. Install custom unistrut and custom threaded rod from building structure to support all display devices

C. Each component shall be labeled for what it does and what it provides. Labels shall be laser-printed, and shall be attached to the front of each unit.

D. LCD Display mounts:
1. Each display that is to be ceiling or wall mounted shall have a UL listed mount.
2. Contractor shall match the display with the manufacturers recommended mount.
3. Verify that the mount is rated to support the weight of the display.
4. Install all mounts so that the display is not located in a main traffic way where persons might injure themselves by running into the mount or display.
5. Ensure that the mount can support the weight of the display, and that the wall can support the combined weight of the display and the mount. Secure to the wall using appropriate supporting screws and lugs.
6. Where attaching to a drywall wall, attach through or into the stud and not just through the drywall.
7. When ceiling mounting an LCD, provide the required length of pipe extension to meet the desired height of the display.
8. Contractor shall ensure the safety of all persons by securely installing the correct mounts for each display.

3.04 FLAT PANEL DISPLAY INSTALLATION

A. Flat panel display installation:
1. Displays shall be installed where shown on the drawings. Contractor shall field verify the location of all displays prior to final installation.
2. When mounting the displays to the wall, the Contractor shall verify that the mount is the correct size, and will support the weight of the display.
3. When mounting the display from a drywall wall, the Contractor shall connect into or through the wall studs. Attachment just into the drywall is not acceptable.
4. When mounting the displays to the wall, locate them to minimize the possibility that they will be in the path of persons walking near the unit.
5. Contractor shall verify ADA compliance with the installation of all projectors and displays.
6. The display shall be connected to the source via patch cables. The Contractor shall provide and install all patch cables required.
7. Contractor shall test that the display works with the inputs, and that the remote control (if applicable) has batteries and works with the system.
8. Contractor shall set up the display so that the picture is clear and set the correct color, brightness, contrast, etc. Install all display items so that glare from natural or manmade light is minimized for all those that will view the display.
9. When mounting the display, the Contractor shall ensure that it is installed and secured to minimize the chance of falling and causing possible injuries.
10. Contractor shall set up a time to review the installation with the Owner and Engineer. During the review, the Contractor shall demonstrate that each display works and is installed safely and securely.
11. When LCD is controlled with a control system provide all cables and test all control of the display.

B. Interactive flat panel installation
1. Mount the LCD to the Mount and to the wall.
2. Connect to all inputs and outputs
3. Provide additional hardware and supports to mount all equipment noted to be mounted behind the LCD.
4. Connect the LCD to the power and USB and HDMI cable to the display.

a. Connect the Ethernet network cable with a patch cable if the LCD is so equipped.
b. Identify the cable and the port it is connected to in the Ethernet switch.
c. Enter this data into a spreadsheet and provide to owner or network contractor for configuration of the Ethernet ports.
d. Provide and install patch cables at flat panel and at the comm room.

5. Set the contact points on the display for the interactive portion of the screen. Set all points and configure the “pens”
6. Load all interactive software on the teacher’s PC.

3.05 UTP AUDIO AND VIDEO TRANSMITTERS AND RECEIVERS

A. The UTP devices shall be used to transmit the signals for the various displays.
B. Install all cables required to transmit signals from source to display output. Provide all patch cables for complete connectivity.
C. The transmitter shall be connected to the source device as shown on the drawings. The contractor shall make all audio and video connections.
D. At each display the contractor shall configure the receiver to compensate for any skew of the signal.
E. Connect the audio and video outputs of the receivers to the video displays.

3.06 TESTING (PRE-COMMISSIONING)

A. All systems shall be initially adjusted and set by the contractor, unless otherwise specified, in writing, by the Consultant or the architect.
B. A complete mechanical and electronic inspection to verify proper installation and operation shall be made, including mountings, interconnection, video scaling and sizing. Test procedures and documentation of results shall be provided with the system documentation.

3.07 COMMISSIONING

A. The video Contractor will provide a technician to assist the Consultant during the commissioning of the system. The technician will be ready and available to make any necessary adjustments or repairs to the system that the Consultant finds in error of the specification.
B. The Video Contractor will have on hand all installation documentation and equipment manuals. The Contractor will have the necessary tools available for any adjustment or repairs. Once the system is commissioned, the Contractor will provide final As-built documents to the Consultant for review.

END OF SECTION 28 5401

SECTION 28 5450 – AUDIO EQUIPMENT

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Parts and equipment required for audio enhancement and distribution.

1.02 SYSTEM DESCRIPTION

A. The audio system shall be installed and configured to provide maximum coverage in each room.

B. The audio systems shall be installed to provide the easiest user interface possible.

1.03 COORDINATION

A. Coordinate the location of all racks, cabinets, and equipment with other contractors.

B. Coordinate with other Contractors who are doing work in the ceiling space. Coordinate the installation of all cables, speakers, etc., with the locations of other services.

PART 2 - PRODUCTS

2.01 AUDIO AMPLIFIERS

A. General Audio Amplifier

1. All amplifiers shall be rack mounted.
2. Amplifier shall employ a safety system to protect itself and speakers from line shorts, thermal overload, power surges, signal degradation, and signal overload.
3. Inputs shall be 3.5mm or direct wired connectors
4. Amplifier shall be capable of mono or stereo output and processing.
5. Input sensitivity of .05 percent at 8 ohms, 1 kHz or better
6. Amplifier shall have LED’s showing that the input is connected, that 1 or more of the protections for the unit have been activated, and that the unit has activated its output limiters.
7. Frequency response of 20HZ to 20KHz
8. Audio amplifier shall be QSC SPA series or equal.
9. See table for different amplifier types
10. Channels 2 4 2 4
11. Stereo Mode (all channels driven)
12. 8Ω 60 W 60 W 200 W 100 W
13. 4Ω 60 W 60 W 200 W 100 W
14. Bridged Outputs (per bridged output pair)
15. 8Ω & 4Ω 200 W 200 W 400 W 200W
16. 70V 250 W 250 W 350 W 350 W*
17. 100V 250 W 250 W 350 W 350 W*

QSC Part #	SPA2-60 2-channel	SPA4-60 4-channel	SPA2-200 2-channel	SPA4-100 4-channel
Stereo mode @4&8 OHM	60W	60W	200W	100W
Bridged @4&* OHM	200W	200W	400W	200W
70/100 volt bridged	250W	250W	350W	350W

B. Large Ethernet attached audio Amplifiers:

1. The power amplifier shall be a four-channel network-processing device that is designed to operate exclusively with a QSC q-sys ecosystem on a gigabit ethernet network.
2. The amplifier shall be powered by a universal switch-mode power supply that supports operation at any ac voltage from 100 to 240 v at 50 or 60 hz.
   a. The amplifier shall be cooled by forced air, with the intake at the rear and exhaust at the front. The fan speed shall be thermally controlled and also shall be visible in units of revolutions per minute (rpm) on the amplifier’s front panel as well as on its network control panel.

3. The amplifier shall utilize a class d output circuit topology with four individual channels (a through d) providing up to 8000 watts (maximum short term) total power and 4800 watts (continuous) total power.
4. The amplifier outputs shall utilize a technology called flexamp™, which provides up to 4000 watts of power to each pair of channel outputs, to be apportioned between themselves as needed. The outputs shall also utilize flexible amplifier summing technology™, which allows multiple channel outputs to also be combined in series (i.e., bridged) and/or parallel.
5. The amplifier shall be configurable via q-sys, including arranging the output channels as single units as well as in various bridged and parallel combinations. The amplifier's audio signals shall originate in the q-sys ecosystem and shall also be configurable in q-sys.
6. The power amplifier shall have no analog audio inputs, but only shall receive audio streaming data from the q-sys ecosystem.
7. The power amplifier shall meet the following performance criteria:
   a. typical distortion (into 8 ohm loads) of 0.02% to 0.05%;
   b. maximum distortion (4 to 8 ohms) of no worse than 1%;
   c. a frequency response (into an 8 ohm load) of from 20 hz to 20 khz at ±0.25 db; noise at -104 db (a weighted, with output section muted); ihf damping factor of greater than 100.
8. Channel muting and gain shall be controllable via the amplifier's front panel controls or the q-sys ecosystem. Changes made either way shall immediately reflect in the other as well. The amplifier shall indicate network status and monitoring, including faults. The front panel shall offer a summary of fault and error conditions.
9. The amplifier shall have output load monitoring on each output. The load monitor shall have the range to detect and calculate impedance of conditions including short circuits, low impedance loudspeakers, and lightly loaded 70 v and 100 v lines with impedances as high as 1 kω.
10. The amplifier rear panel shall feature dual rj-45 jacks for connecting to the QLAN network, enabling integration into the Q-SYS ecosystem for bi-directional passage of digital audio, control signals, and status monitoring data. T
11. he rear panel shall provide four 3-pin phoenix connectors for the balanced analog audio inputs (for mic or line signal levels), and four touch-proof phoenix connectors for connecting loudspeaker cables to the channel outputs.
12. The multi-channel system-processing amplifier shall be the QSC #CX-QN series.

2.02 AUDIO MIXERS / DIGITAL SIGNAL PROCESSORS

A. Multi-Channel, Multi-Function Signal Processor
1. The device shall provide MIC and balanced line-level inputs and line-level outputs. The inputs shall be 100% controllable via software, including gains.
2. The system processor shall provide up to 160 x 160 networked audio channels, individually configurable as either Q-LAN, AES67, or Dante formatted networked audio.
3. Shall include 8 x 8 Software-based Dante network audio channels and shall be licensable for up to 64 x 64 Software-based Dante capacity.
4. The system processor shall support 24 total analog I/O inputs/outputs and shall be presented in the following groupings:
   a. 8 Mic/Line inputs,
   b. 8 Line outputs and
5. The system processor shall be capable of connecting to any host PC, Mac or embedded device via USB and will present itself as up to four virtual external sound devices, each offering Speakerphone (with or without Acoustic Echo Cancellation) or a Soundcard plus a single USB Webcam for Soft-Codec conferencing and other applications.
6. The system shall perform all its real-time audio, video and control processing using Intel processors running a purpose-built, real-time Linux operating system

7. The system processor shall operate natively on a standard gigabit Ethernet infrastructure and shall employing DiffServ quality of service, IGMP, IEEE 1588-2008 (PTPv2) precision time protocol, UDP/IP audio and video transport with floating-point format audio data representation.
8. The system shall support 802.1x authentication.
9. The system shall not require IEEE 802.1AS, IEEE 802.1Qat, or IEEE 802.1Qav support on the network infrastructure to function.
10. The overall system latency from analog input to synchronized analog outputs anywhere on the network shall be 3.167 ms.
11. The system shall also be able to achieve an overall system latency of 3.167 ms over Layer-3 routed network infrastructure without any additional hardware, software or connection services between subnets.
12. The system processor shall manage external control interfaces such as
    a. Touchscreen Controllers,
    b. Paging Stations,
    c. Networked Audio I/O Expanders,
    d. Network Connected Amplifiers,
    e. AV-to-USB Bridging interfaces
    f. IP-based PTZ Conference Room Cameras.
13. A web interface shall provide basic network, services, and security configuration, status, and log retrieval. The system processor shall be natively integrated into Designer Software for network discovery, real-time configuration, control, monitoring, supervision, and management.
14. On the rear panel, the system processor shall minimally include:
    a. Two (2) 3-pin RS232 Euro Block connectors,
    b. Two (2) USB Type-A Device ports to provide USB HID Bridging functionality,
    c. One (1) USB Type-C Device port to provide AV-to-USB Bridging capability
    d. Four (4) RJ45 connectors for Q-SYS Network functions.
15. The system processor shall offer up to 24 channels of built-in configurable Acoustic Echo Cancelation at the default tail length of 200 ms
16. The system processor shall store, and operate from, a single design that shall be comprised of audio, video, and control components, wiring, links, text, and graphics on a single or multiple schematic pages.
    a. Designs shall include any of the following audio DSP, video, test and measurement components, control components, and layout components:
        1) Acoustic Echo Cancellers, Audio Players, Audio Streaming components, Crossfaders, Crossovers, Delay components, Auto Gain control elements, Compressors, Gates, Duckers, Expanders, Ambient Noise Compensators, Limiters, Gain blocks, Graphic Equalizers, Parametric Equalizers, FIR Filters, All-Pass Filters, Band-Pass Filters, Band-Stop Filters, High-Pass Filters, Low-Pass Filters, FIR High-Pass filters, FIR Low-Pass Filters, Dual-Shelf Equalizers, Notch Filters, Meters, Matrix Mixers, Gain-Sharing Automatic Mixers, Gated Automatic Mixers, Signal Routers, Public Address Routers, Room Combiners, Signal Presence Meters, SIP Softphone instances, Tone Generators, Noise Generators, Dual Trace FFT Measurement Modules, Real Time Analyzers, Signal Injectors, Signal Probes, Logic, Value and Position control functions, Lua scripting components, Command Buttons and Triggers, Camera Router, USB Audio Bridge, USB Video Bridge.
17. The system processor shall support custom user control interfaces on either proprietary touch screen controllers, network computers utilizing a control application, iOS devices, or any device with a standard web browser.
18. Mixer/DSP/AV Controller Shall be QSC Core 24f or equal

B. TOUCHPANELS
1. Include the following accessories for this system.

a. 10” Touchpanel control shall include:
1) Capacitive touch technology
2) Wall or desktop-mount, 12”, 1920 x 1080 LCD Panel with anti-glare safety glass
3) Connection shall be an Ethernet 10/100/1000 Mbps connections
4) Shall host a custom designed touch control interface for the QSC Q-SYS system.
5) Shall be equipped to control and monitor the audio and possibly video system
6) Capable of displaying custom bitmapped graphic images,
7) Powered via PoE (Power over Ethernet) for singlecable connectivity
8) Wall mount touch panel shall be QSC #TSC-101-G3 or equal
9) Where required include a desktop mount.

C. AUDIO DSP ACCESSORIES
1. Bluetooth and Combo input plate
a. Provide and connect a faceplate/combo device for Bluetooth Connectivity and 3.5mm audio input.
b. Shall be Network attached and PoE Powered.
c. Two-gang plate with GFI Style openings. Provide custom cover plate.
d. Shall be Dante enabled and connected to the DSP device.
e. Setup the Bluetooth passwords for the owner.
f. Combo Plate shall be QSC #unD610-BT-White
2. Bluetooth -Dante Faceplate
a. Provie and install a network attached, Dante based Bluetooth faceplate to allow Bluetooth connectivity to the audio system
b. Input plate shall Dante or AES67 networked, wall-mounted audio interface that provide bidirectional Bluetooth audio.
c. Shall be configurable thru network software from the manufacturer. Provide a copy of the software to the owner. Load on their PC and configure the device.
d. Controllable Bluetooth functions shall include:
1) Pairing or un-pairing,
2) Media source track selection (play, pause, next track, last track)
3) Level adjustment from the originating Bluetooth device.
e. The device shall fit into a standard US single-gang electrical box
f. Shall be RDL #D-BTN21 or equal.

D. Ethernet Switch
1. Provide a rack mounted Ethernet switch in the audio/video system that supports routing and distribution of Audio and Video Signals throughout the system.
2. Switch shall be:
a. Rack mounted and powered from 120 volt power
b. Capable of PoE+ output for most ports
c. Equipped with a power supply to support PoE+
d. Equipped to support Dante Digital Audio distribution
e. Video over IP Signal distribution
3. Ethernet switch shall be QSYS #NS26-480+ or equal. Size as required to drive all equipment.

2.03 AUDIO DEVICES

A. Provide and install Line Level Audio Distribution Amplifier.
1. RDL Labs #ST-DA3
2. Equip with power supply, RD Labs #PS-24AS

B. Audio extenders via UTP cable.
1. Provide sending and receiving devices to send and receive audio signals via UTP cable.

2. Provide and install all UTP cables.
3. See drawings for transmitters and receivers. Provide a complete system.
4. Where faceplates are to be provided, equip with coverplates.
5. Install a receiver for the sending unit and connect as an input to the audio system.
6. Install cabling from the receiver to the sending unit.
7. Connect to one of the ports on the audio mixer/dsp.
8. All cabling shall be plenum rated
9. Transmitters:
   a. Rack or Wall mounted Line level audio to CAT-6, Active shall be RDL #TX-TPS1A or equal
10. Receiver shall accept the UTP cable and provide line level output to the mixer or DSP.
    a. Provide receiver that matches the number of input plates.
    b. Single line receiver shall be RDL #TX-TPR1A or equal.
    c. Equip with power supply, RDL #PS24AS or equal.

2.04 WIRELESS MICROPHONES

A. Wireless Microphone Kits:
1. Wireless systems shall be based around the Audix R41 or R42 series receiver.
2. Equip with the following where required.
   a. AUDIX Antenna Amplifier/Distro for System #ADS48
   b. AUDIX External, Remote Directional Antenna #ANT-D360
   c. For antenna cable to remote antennas, use Belden RG6 UHF Cable #1829A for ANT-D360 Antennas
   d. Mount the Remote antennas up at the red iron to cover the entire room
3. Wireless Receiver shall have two channels or provide multiple single channel receivers.
   a. 32 MHz Wide spectrum tuning receiver
   b. 106 Pre-coordinated frequencies
   c. Up to 4 systems (8 channels) simultaneous use
   d. 21 dB Audio gain stage in 3 dB steps
   e. Internal antenna combiner for dual antenna operation
   f. 300’ (91 meters) Operating range
   g. 19” Rackmount chassis with front mount antenna kit shall be included
   h. Dual Channel Receiver shall be Audix R42 or equal
4. Bodypack shall be:
   a. 64 MHz Wide spectrum transmitter
   b. Precision metal housing
   c. Modular antenna design
   d. May be used with lavalier, head worn and instrument mics
   e. AF and RF gain control
   f. High contrast LCD display with group, channel and battery indicator
   g. Soft mute switch
   h. 10 Hour run time - AA batteries
   i. Provide (3) three sets of batteries
   j. Shall be Audix B60 or equal. Shall be compatible with receiver
5. Wired/Head worn wireless microphone shall consist of:
   a. (1) Audix #HT2 Professional head worn Microphone with Supercardiod capsule or equal
6. Lavalier wireless microphone. It shall consist of:
   a. (1) Audix #L5 Professional Lavalier Microphone with Cardioid capsule
7. Handheld wireless mic/transmitter shall be
   a. 64 MHz Wide spectrum transmitter
   b. Durable metal housing
   c. AF and RF gain control
   d. Modular and interchangeable capsule assemblies
   e. High contrast LCD display with group, channel and battery indicator

f. Soft mute switch
g. 10 Hour run time - AA batteries
h. Shall be Audix #H60 or equal.

B. Wireless Microphone Extension Antenna.
1. Where required the contractor shall install an antenna in the room where the microphones are to be use.
2. All cabling shall be plenum rated unless noted otherwise.
3. When more than 1 wireless microphone will be used in the same room and the receivers are to be installed in a rack or cabinet, the Contractor shall provide an active antenna combining unit.
4. The antenna combiner shall be rack mountable.
5. Provide the correct antenna extension kit with the active combiner to place the antennas in the same room as the transmitter.

2.05 WIRED MICROPHONES

A. Wired microphone for handheld use shall have the following characteristics:
1. The microphone shall be equipped with a lockable ON/OFF switch and an internal impedance selection socket located on the XLR connector for switching between high and low impedance. A slip in swivel adapter shall be supplied for the convenience of stand mounted use.
2. Controlled low frequency response combined with a smooth high frequency rise for clear and intelligible voice pickup.
3. Hypercardoid pickup pattern for minimized feedback.
4. Spherical grille shall provide effective filtering out of breath noise and popping when used for close up vocals, and of wind noise when used outdoors.
5. Lockable ON/OFF switch.
6. Equipped with a 3-pin professional audio (XLR) connector.
7. Frequency response shall be 50 to 18,000 Hz.
8. Wired, handheld microphone shall be Audix #OM3 or equivalent.
a. Provide a 25-foot microphone cable with each microphone.

2.06 RACK AND CABINET ACCESSORIES

A. Surge Protection and power strip.
1. This device will provide the only power on-off switch for the sound system.
2. All equipment mounted in the rack will be connected to this device.
3. No electronic device shall be powered from any non-protected power source
a. SurgeX, # SX1120RT 20A/120VAC;

B. Rack Mount drawer:
1. Drawer shall be mounted in standard 19 inch mounting rails.
2. Drawer shall be made of steel and shall be black in color.
3. 4-RU Rack-mount drawer shall be Lowell #UDEL-414.

C. Where required, provide a balancing transformer for Ipod connections. Transformer shall be RDL #TX-10B or equal.

D. Custom Input and Output rack mount panel.
1. Contractor shall provide a panel that mounts in a standard 19” rack.
2. Panel shall hold all input and output connectors shown on the drawings and listed in the specifications.
3. Panel shall include custom screen printing to detail what the connectors are connected to.
4. Connect each connector to it’s associated input on the audio equipment.
5. Panel shall be made of steel and shall be black in color with white lettering.
6. See the drawings for the proposed layout of the panel. Provide a submittal showing the actual layout prior to ordering.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Location of the communications infrastructure shall be finalized in the communications room prior to installation.

B. Locate all equipment to be installed, and make certain that space is available for maintenance and service during the life of the system.

C. If any changes from the drawings are required, the Contractor shall submit a proposed layout of the communications layout to the Engineer for approval prior to installation.

3.02 AUDIO ELECTRONICS INSTALLATION

A. Contractor shall review design and building prior to ordering all components.

B. The Contractor shall be responsible for providing a complete system including all parts required for connectivity of all components.

C. All cables, connectors, supports, boxes, etc., shall be the responsibility of the Contractor.

D. The Contractor shall refer to the drawings for the installation notes and locations in the racks of all the equipment. If changes are required in the field, the Contractor shall submit the proposed changes in the form of updated rack/cabinet layouts. The Engineer shall have the final say on proposed changes.

E. All components required for a well-functioning system shall be provided and installed.

F. Interconnections between speakers and amplifiers shall be via terminal strips. Speakers shall not be directly connected to an amplifier. Terminal strips shall be mounted to the side of a cabinet, or to a piece of wood mounted to the back of the rack.

1. Provide self-adhesive labels for each of the speaker wires that come back to the terminal strip. Attach stickers to the area beside the terminal that the wire is connected to.
2. All wires terminated to the terminal strip shall have spade lugs attached. Size the spade lugs for the size wire and size of screw on the terminal strip.

G. When connecting speakers to the amplifiers, ensure the correct polarity throughout the system.

H. Contractor shall label all the volume, gain, etc., controls on all mixers and processors. The labels shall be self-adhesive labels. All labels shall specify the device that dial controls. All labels shall be laser-printed; handwritten labels are not allowed.

I. After connection of the system, the Contractor shall configure all components to ensure the best sound possible.

1. Contractor shall ensure that the correct speakers are connected to the correct output of the amplifier. This includes the surround sound processor (if applicable) and amplifier. contractor shall ensure that connections are made to each speaker.
2. Audio output shall be routed through the digital signal processor (if applicable) to limit the feedback noise to the speakers. Contractor shall consult with the manufacturer and ensure that the eliminator has been configured correctly.
3. Where a graphic equalizer is installed, the Contractor shall balance all the signals to provide the best sound possible. Utilize an acoustical tester.
4. All inputs such as CD players shall be integrated into the system. Utilize mixers and automatic mixers to combine microphones and other inputs.
5. Contractor shall test each and every input and output of the system. Contractor shall have the Engineer and Owner present for final testing and system checkout.

J. After installation, the Contractor shall provide as-builts and all component documentation.

K. Assisted listening systems shall be installed to support audio enhancement for people during use of the audio system in the specific room.

1. Assisted listening systems shall be installed to support the personal audio devices that are handed out to the users
2. Test the devices in the room so that they are shown to pick up the audio signal throughout the room
3. Provide the devices to the owner with new batteries and a set of spare batteries.
4. Connect the system to the main audio output in the cabinet.

3.03 MICROPHONE INSTALLATION.

A. All wired microphones shall be provided with a microphone cord. The cord shall have a female XLR connector for connection to the microphone, and a male connector for connection to the wallplate.
   1. Each cable shall be a minimum of 15 feet long. For gymnasiums and other locations where a longer cable may be required, provide a cable no shorter than 25 feet.
   2. At each wallplate/floorbox connection to an XLR, provide an engraved lamacoid label detailing the number of the microphone cable attached to the back of the wallplate. Stick the label to the wallplate just above the XLR connector.
   3. Contractor shall install wireless microphones where shown on the drawings.
   4. Wireless receiving units shall be rack mounted.
   5. Where the receiving unit is not in the room where the transmitter is located, the Contractor shall install antenna extensions for each receiver.
   6. The antenna shall be mounted in the room where the transmitter is to be located. Install the extension cables and antenna as per the manufacturer's recommendations.
   7. Where more than 1 receiver is in the same rack/cabinet, the Contractor shall install an active antenna consolidator that has the capability to combine up to 4 receivers. This consolidator shall then have antenna extensions located in the room the users will be transmitting from.
   8. Contractor shall be responsible for all cables and connectors needed to connect antennas.
   9. Provide either a handheld wireless microphone or belt pack and lavalier/headworn mic with each wireless receiver. Refer to the drawings for the type of microphone to provide.
      a. Contractor shall match the transmitter frequency to the receiver frequency.
      b. Where multiple receivers are required, ensure that the frequencies are all different, and that there will be no interference from the local radio signals from TV stations.
      c. Label each receiver and transmitter for the frequency chosen.
   10. Contractor shall provide wind screens for all microphones provided.
   11. After installation, the Contractor shall demonstrate that each wireless microphone works at any point in the room that it serves. The Contractor shall further demonstrate that the microphones all can work at the same time without interference.
   12. All microphones shall have new batteries provided at the time of installation.

3.04 AUDIO SYSTEM

A. The entire audio systems shall be configured to be a complete working system.

B. The Contractor shall label each speaker cable at each end with a wraparound label that has been laser printed.
   1. The Contractor shall give each speaker wire a separate designator. The Engineer shall approve the proposed numbering prior to printing the labels.

C. Each component shall be labeled for what it does and what it provides. Labels shall be laser printed, and shall be attached to the front of each unit.
   1. For example, the amplifier in a cabinet may be marked "Microphone Amplifier-First Floor Hallway."

D. It is extremely important that each microphone cable be labeled at each end with a laser printed wrap around label. This will allow the Owner to know exactly which microphone is being connected.
   1. Where microphones are terminated, the Contractor shall provide a minimum of 3 feet of spare cable for future movements.
   2. The Contractor shall provide the proposed labeling of the microphone cables prior to the actual installation of the labels.

3.05 TESTING (PRE-COMMISSIONING)

A. All systems shall be initially adjusted and set by the contractor, unless otherwise specified, in writing, by the Consultant or the architect.

B. A complete mechanical, electronic, and acoustical inspection to verify proper installation and operation shall be made, including mountings, interconnection, freedom from hums, buzzes, noise, and oscillation. Test procedures and documentation of results shall be provided with the system documentation.

C. All microphone and line level signal cables shall be verified for proper “Pin to pin” wiring. Example: Microphone cables; Pin 1 shall be Shield, Pin 2 shall be Positive (high or +), Pin 3 shall be Negative (low or -). Correct any irregularities and include documentation of results that shall be provided with the system documentation.

D. Polarity testing and verification shall be performed by the sound system contractor to verify; “Positive pressure on ALL microphones shall produce positive pressure at ALL loudspeakers.” It is the sound system contractor’s responsibility to correct all discrepancies found. Test procedures and documentation of results shall be provided with the system documentation.

E. Acoustical testing shall be in two phases. In the first, the intent is to obtain and document uniform coverage within the Auditorium seating areas. The intent of the second is to obtain an acceptable room response curve, naturalness of sound, and minimize feedback in all systems.

1. Reproduce 1/3rd octave bandwidth pink noise, that is 10 dB above the ambient level of the gymnasium. Measure the sound levels at a minimum of 12 positions, along the front to back centerline, and along the front to back side aisles of the seating area. Determine that the sound level through the entire seating area is: plus or minus (+/-) 3 dB at 2 KHz. Adjust loudspeakers if necessary, either physically or electrically, to achieve these desired results. Document your results in writing to the Consultant.
2. Reproduce a broadband 20-20KHz pink noise signal that is at least 10 dB above the ambient. Set a measurement microphone at the approximate center of the seating area. While no specific room response curve is specified, it is the intent to obtain a smooth response between 125 and 4000 KHz (+/-2 dB), with roll off at 3 dB per octave for two octaves above 8000 KHz, with more roll off beyond this frequency. After initial adjustment, reproduce both speech and music on the system and check for the naturalness of both, readjusting the EQ as necessary. Document filter settings and provide to the Consultant.
3. Place the Podium or Handheld (wireless) microphones in their normal positions. Increase the level of each device, one at a time until each microphone is loud enough to be heard in any seat in the room. Document your finding and provide to the Consultant.

3.06 COMMISSIONING

A. The Audio Contractor will provide a technician to assist the Consultant during the commissioning of the system. The technician will be ready and available to make any necessary adjustments or repairs to the system that the Consultant finds in error of the specification.

B. The Audio Contractor will have on hand all installation documentation and equipment manuals. The Audio Contractor will have the necessary tools available for any adjustment or repairs.

C. Once the system is commissioned, the Audio Contractor will provide final As-built documents to the Consultant for review. These documents will reflect the true condition of the system after commissioning.

END OF SECTION 28 5450

SECTION 28 5453 – AUDIO SPEAKERS

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Parts and equipment required for audio speakers and speakers supports.

1.02 SYSTEM DESCRIPTION

A. The speakers shall be installed and configured to provide maximum coverage in each room.
B. Install to allow maintenance to all speakers.
C. Each speaker in an open ceiling shall be equipped with an aircraft cable safety cable.

1.03 COORDINATION

A. Coordinate the location of all racks, cabinets, and audio equipment
B. Coordinate with other Contractors who are doing work in the ceiling space. Coordinate the installation of all cables, speakers, etc., with the locations of other services.

PART 2 - PRODUCTS

2.01 PENDANT MOUNT SPEAKERS

A. Open Ceiling suspended speaker-LARGE
   1. Provide and install the pendant-style 2-way co-axial system shall incorporate a 6.5-inch woofer with a treated-paper cone and a 19 mm aluminum dome tweeter.
   2. The tweeter shall be mounted coaxially in front of the woofer on a waveguide that matches the directivity of the two drivers at the 1900 Hz crossover point.
   3. The system shall meet the following performance criteria:
      a. conical coverage angle of 135 degrees;
      b. effective frequency range of 56 Hz to 20 kHz +0/-10 dB, measured on axis;
      c. broadband sensitivity of 88 dB (measured at 1 m with 4 V rms input); maximum continuous output of 106 dB SPL and maximum peak output of 112 dB SPL on axis at 1 meter;
      d. power handling of 60 watts for 8 hours with an IEC noise signal; recommended amplifier power of 120 watts; nominal impedance of 16 ohms.
   4. The loudspeaker shall have a switchable low-distortion, wide-bandwidth laminated core transformer with taps for 60, 30, 15, and 7.5 watts at 70V and 60, 30, and 15 watts at 100V.
   5. The loudspeaker enclosure shall have a steel hanger tab for support and shall include two 3.25 m quick-link 2 mm suspension cables with slip-lock fasteners. The loudspeaker connections shall be a locking 4-pole Euro-block that accepts two 12 AWG wire pairs.
   6. The loudspeaker shall be QSYS #AD-P6Tor equal

B. Open Ceiling Subwoofer
   1. Provide and install the pendant-style subwoofer.
   2. Speaker shall include the following:
   3. LF transducer 6.5 in (165 mm) dual voice-coil weather treated paper cone woofer
   4. Effective frequency range 50 Hz – 150 Hz
   5. Rated noise power / voltage 100 W / 20 V (rms)
   6. Sensitivity [dB] (rated @1 W, 1 m) 86
   7. Coverage (-6 dB) Omni
   8. Directivity index [dB]
   9. Maximum SPL [dB] 105 / 108 / 111 (continuous / program / peak)
   10. Recommended amplifier 100 W
   11. Transformer taps / impedance
      a. Bypass:4 Ω
      b. 100 W (70 V); NA (100 V) Tap: 50 Ω

c. 50 W (70 V); 100 W (100 V) Tap: 100 Ω
d. 25 W (70 V); 50 W (100 V) Tap: 200 Ω
e. 12.5 W (70 V); 25 W (100 V) Tap: 400 Ω

12. Connectors: Mono input: 4-pole Euroblock with thru output
13. Ceiling mounted subwoofer shall be QSYS # AD-P.SUB or equal

2.02 IN-CEILING SPEAKERS -HIGH END AUDIO

A. There are numerous type of speakers, and there are numerous applications for each of those speakers. The Contractor shall refer to the drawings and identify which speakers shall be installed for the most complete and well-designed sound enhancement system.

B. Medium speaker -Drop ceiling mount.
1. Speaker shall have a 6.5-inch low frequency transducer with a waveguide coupled 1" tweeter.
2. Frequency response shall be 50 to 20,000 Hz at -10dB.
3. Speaker shall have 70-volt transformer taps with 30 watts being the top end.
4. Long term power handling shall be 80 watts with peak of 320 watts at 8 ohms
5. Sensitivity shall be 90 dB SPL at 1 meter with 1 watt of pink noise.
6. Speaker shall be fully enclosed with a screen-grill and shall be white in color.
7. Each speaker shall be equipped with a mount and hardware that provides for its installation in the drop ceiling. Shall mount from the Grid
8. Speaker shall be Electro-voice #C6.2-G2 or equal.

C. Field house wedge (can be used for auditorium etc)
1. Provide and install large speakers for the noted installation location.
2. Shall be a Two-way, dual-6-inch point source loudspeakers with directivity control
3. Shall incorporate
a. Two 6-inch (170 mm) low frequency ceramic transducers mounted in a 90° V shape
b. One, 1.75-inch (44.5 mm) voice coil
c. One, 1-inch (25.4 mm) throat high-frequency neodymium compression driver mounted to a configurable rotatable horn.
d. The horn shall be constituted of two half horns. The different half horn assemblies shall offer the following coverage options:
A) Symmetrical: 120° x 50°, 90° x 50°
B) Asymmetrical: 105° (60° + 45°)
C) Contractor shall measure area to be covered with audio and provide the correct horn assembly
4. The loudspeaker system shall be capable of operation in either passive mode or bi-amped with a crossover frequency of 1.5 kHz in bi-amp and 1.6kHz in passive mode.
5. The loudspeaker system shall meet the following performance criteria:
a. Frequency response of 70 Hz to 20 kHz, measured on-axis;
b. Sensitivity (1W @ 1m) of minimum 101 dB SPL in free field;
c. Maximum rated SPL at 1m (passive) of 117 dB continuous and 129 dB peak (crest factor of 12 dB);
d. Rated power capacity (passive) of continuous 240W based on a two-hour power test; nominal impedance of 8 Ohms.
6. The loudspeaker system input connectors shall include both two NL4 Speakon connectors and one euroblock connector.
7. The loudspeaker enclosure shall be asymmetrical offering a 15° angle between sides and constructed of 12 mm Baltic birch exterior plywood and finished in black polyurea paint (RAL 9011).
8. The transducers and horn frame shall be part of an ABS front baffle.
9. The front of the loudspeaker shall be protected by an 18-Gauge (1.2 mm) powder-coated steel grille that is lined with acoustically transparent backing and a stainless metallic screen to prevent water ingress and is free of logos or other embellishment.
a. This grille shall be treated against UV and corrosion.

10. The loudspeaker shall be IP54, and all exterior fasteners shall be stainless steel. The input cup shall be protected by a sealing plate.
11. The enclosure shall have two M8 inserts located on center of gravity on the top and bottom for an optional yoke bracket as well as three 4-hole pattern (4 x 2.25 pitch, M6) located on top, bottom and rear.
    a. Provide and install the Yoke bracket and any other bracket or supports required for proper mounting
12. The two-way full-range loudspeaker system shall be the Q-SYS #PL-DC26 loudspeaker.

D. Field House Speaker
1. Provide and install large speakers for the noted installation location.
2. Shall be a Two-way, full-range 15-inch coaxial loudspeaker
3. The professional high-power installation loudspeaker system shall be a two-way full-range design incorporating a 15-inch low-frequency neodymium transducer with a 3-inch (72.6 mm) voice coil and a 3-inch (76.2 mm) throat high-frequency neodymium compression driver mounted coaxially with the LF transducer.
4. The coverage shall be 80° conical and respect Direct Match Transition (DMT) technology.
5. The loudspeaker system shall be capable of operation in either passive mode or bi-amped with a crossover frequency of 1 kHz in bi-amp and 1700Hz in passive mode.
6. The loudspeaker system shall meet the following performance criteria:
    a. Frequency response of 37 Hz to 20 kHz, measured on-axis;
    b. Sensitivity (1W @ 1m) of minimum 100.5 dB SPL in free field;
    c. Maximum rated SPL at 1m (passive) of 117.5 dB continuous and 129.5 dB peak (crest factor of 12 dB);
    d. Rated power capacity (passive) of continuous 340W based on a two-hour power test; nominal impedance of 8 Ohms.
7. The loudspeaker system input connectors shall include both two NL4 Speakon connectors and one Euroblock connector.
8. The loudspeaker shall be IP54 rated for indoor and outdoor installations. All exterior fasteners shall be stainless steel. The input cup shall be protected by a sealing plate.
9. Mounting
    a. The enclosure shall have twelve M10 threaded-insert mounting points (two on each side, three on the top and bottom) for suspension via eye bolts,
    b. Shall include two M8 inserts located on center of gravity on the top and bottom for an optional yoke bracket as well as three 4-hole pattern (4 x 2.25 pitch, M6) located on top, bottom and rear.
10. The two-way full-range loudspeaker system shall be the Q-SYS PL-CA15 loudspeaker.
11. Provide custom installation to fly speaker and mount to structure.
    a. Contractor shall be responsible for custom install and aiming speaker to cover the area and minimize “stray” audio.

E. Field House Subwoofer
1. Provide and install Passive 18-inch installation subwoofer for the noted installation location.
2. The subwoofer shall be a bass reflex design incorporating an 18-inch low frequency ceramic transducer with a 4-inch voice coil.
3. The subwoofer shall meet the following performance criteria:
    a. Frequency response of 38 Hz to 101 kHz, measured on-axis; sensitivity (1W @ 1m) of minimum 97 dB SPL in half space;
    b. Maximum rated SPL at 1m (passive) of 126 dB continuous and 138 dB peak (crest factor of 12 dB);
    c. Rated power capacity (passive) of continuous 750W based on a two-hour power test; nominal impedance of 8 Ohms.
4. The subwoofer input connectors shall include both two NL4 Speakon connectors and one euroblock connector.

5. The subwoofer shall be IP54 rated, and all exterior fasteners shall be stainless steel. The input cup shall be protected by a sealing plate.
6. The subwoofer shall have a 6-point integrated rigging system allowing the deployment of 6 subwoofers with a safety factor of 10:1.
7. Provide custom installation to fly speaker and mount to structure.
    a. Contractor shall be responsible for custom install and aiming speaker to cover the area and minimize “stray” audio.
8. The loudspeaker shall have a net weight of no more than 102.2 lb (46.3 kg).
9. The Passive 18-inch installation subwoofer shall be the Q-SYS #PL-SUB18 loudspeaker.
10. Provide custom installation to fly speaker and mount to structure.
    a. Contractor shall be responsible for custom install and aiming speaker to cover the area and minimize “stray” audio.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Location of the communications infrastructure shall be finalized in the communications room prior to installation.
B. Locate all speakers and ceiling types where speakers are to be installed, Review prior to ordering and provide correct speakers and speaker mounting hardware
C. Where speakers are mounted from the ceiling or other structure the contractor shall provide all mounting hardware and misc. hardware.
D. If any changes from the drawings are required, the Contractor shall submit a proposed layout of the speakers to the designer for approval prior to installation.

3.02 IN-CEILING SPEAKERS

A. In-Ceiling speakers shall be mounted flush with the ceiling.
B. The Contractor shall provide all equipment required to flush mount the speaker into the drop ceiling or plaster ceiling. Refer to reflected ceiling plan for ceiling type.
C. Contractor shall work with the Engineer and ceiling installer to locate all speakers where other equipment will not impede the installation.
D. Where the manufacturer provides a T-bar support for the speaker, the Contractor shall provide and install the support in drop ceiling installations.
E. Speaker wire shall not lay on the ceiling. All speaker wire shall route through conduit, tray or J-hooks.
F. The Contractor shall leave a coil of speaker wire in the ceiling to allow lowering of the speaker for maintenance and removal.
G. The Contractor shall work with the manufacturer to determine the best layout of the speakers, and shall submit that layout for review prior to installation. The Engineer shall approve the installation prior to installation.
H. After installation, the entire system shall be tested, and it shall be demonstrated that each speaker is connected and in good working order.
I. It shall be further demonstrated that all audio can be easily heard throughout each room where speakers have been installed.
J. Contractor shall provide all speaker wire and connectors required to connect the system.
K. Ensure that all speakers have been connected to the correct amplifier.
L. For speakers in the commons area, the contractor shall install a safety strap that consists of an aircraft cable attached to the structure and the speaker housing.

3.03 WALL OR OPEN CEILING SPEAKERS

A. Speakers hung from the ceiling shall be positioned to provide full coverage of the area.
B. The Contractor shall suspend speaker from the ceiling where shown on the drawings. The Contractor shall be responsible for installing the speakers at the correct angle to fully cover the area.
    1. Complete all calculations to aim all speakers and fully cover the area evenly with audio.
    2. Provide all hardware from manufacturer and misc. hardware required to mount the speakers from the building structure.

C. Contractor shall provide all the equipment required for mounting each speaker. Use manufacturer's recommended supports when possible.
D. Align speaker so that they provide full coverage of the area.
E. The Contractor shall leave a coil of speaker wire in the ceiling to allow lowering of the speaker for maintenance and removal.
F. The Contractor shall work with the manufacturer to determine the best layout of the speakers, and shall submit that layout for review prior to installation. The Engineer shall approve the layout prior to installation.
G. After installation, the entire system shall be tested, and it shall be demonstrated that each speaker is in connected and in good working order.
H. It shall be further demonstrated that all audio can be easily heard throughout each room where speakers have been installed.
I. Contractor shall provide all speaker wire and connectors required to connect the system.
J. Ensure that all speakers have been connected to the correct amplifier.
K. Where speakers are exterior installed the cabling shall be weatherproof and all connectors shall be weatherproof
L. Install aircraft safety cable to attach each speaker directly to building structure. Shall be in addition to any other custom mounting hardware.

END OF SECTION 28 5453

SECTION 28 5470 – AV CABLING

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. This section includes parts and equipment required for installation, termination, and testing of user communications cables.

1.02 SYSTEM DESCRIPTION

A. Cabling and infrastructure shall be fully installed and connected and labeled.
B. Products and installation detailed in this section shall comply with all applicable requirements.

1.03 COORDINATION

A. All cables shall be coordinated with the installation of the telecommunications raceways.
B. Coordinate all cables with the furniture to be installed in the building. Make any adjustments prior to cable being installed.

PART 2 - PRODUCTS

2.01 UNSHIELDED/TWISTED PAIR CABLING CAT-6

A. CAT-6 UTP cable for Ethernet and IP video Transmission
   1. Category 6 cabling shall consist of 4 pairs of unshielded twisted pair, 23 AWG cables.
   2. All CAT-6 cables shall be installed in cable tray or supported by J-Hooks.
   3. Individual pair shall be marked in the standard 4 pair color code of blue/blue-white, orange/orange-white, green/green-white, and brown/brown-white.
   4. Each cable shall be marked sequentially with the footage of the cable. Each cable shall also be marked with the manufacturer of the cable and the type of cable installed or the cable part number.
   5. CAT-6, 4 pair cabling shall be plenum rated unless specifically noted.
      a. Cat-6 UTP Cables for Audio/Video Connectivity shall be:
         1) White in color, Mohawk #M58580 or equal.
         2) Black in color, Mohawk #M58289 or equal.
         3) Orange in color, Mohawk #M58288 or equal.
   6. Ensure that cable passes all CAT-6 tests after installation.

B. CAT-6 Unshielded Twisted Pair Termination equipment
   1. CAT-6, 8-pin modular jacks for UTP cable shall be:
      a. Data Jacks for Audio and Video connections shall be:
         1) Hubbell #HXJ6W-White
         2) Hubbell #HXJ6BK-Black
         3) Hubbell #HXJ6OR-Orange
   2. Where data cables route back to a rack or cabinet the contractor shall terminate all cables. Rack mount Patch panel shall be Hubbell

C. Patch Panels
   1. Where data cables route back to a rack or cabinet the contractor shall terminate all cables onto modular jacks and those jacks shall be mounted into a patch panel.
      a. Rack mount Patch panel shall be:
         1) Hubbell #HPJ24
         2) Equip each panel with rear cable support bars.

2.02 SHIELDED TWISTED PAIR CABLING

A. CAT-6A STP for Video Transmission
   1. Category 6A Shielded cabling shall consist of 4 pairs of shielded twisted pair, 23 AWG cables.
   2. All CAT-6A cables shall be installed in cable tray or supported by J-Hooks.
   3. Individual pair shall be marked in the standard 4 pair color code of blue/blue-white, orange/orange-white, green/green-white, and brown/brown-white.
   4. Each cable shall be marked sequentially with the footage of the cable. Each cable shall also be marked with the manufacturer of the cable and the type of cable installed or the cable part number.
   5. CAT-6A, 4 pair shielded cabling shall be plenum rated unless specifically noted.
      a. Cat-6A STP Cables for Audio/Video Connectivity shall be:
         1) White in color, Mohawk #M59242 or equal.

2) Black in color, Mohawk #M59244 or equal.
3) Orange in color, Mohawk #M59238 or equal.

6. Ensure that cable passes all AV Signals after termination.

B. CAT-6A Shielded Termination equipment
1. CAT-6A, 8-pin modular jacks for STP cable shall be:
a. Data Jacks for Audio and Video connections shall be:
1) Hubbell #HJS6AW-White
2) Hubbell #HJS6ABK-Black
3) Hubbell #HJS6AOR-Orange

C. Where data cables route back to a rack or cabinet the contractor shall terminate all cables onto modular jacks and those jacks shall be mounted into a patch panel.
1. Rack mount Patch panel for CAT-6A Shielded cables shall be:
a. Hubbell #PSJ24BK
b. Equip each panel with rear cable support bars.

2.03 FACEPLATES

A. Custom AV plates.
1. Some locations will require custom stainless-steel plates. These shall be configured with the correct connectors and pass thru's to support all the data, audio and video.
2. All shall be silk-screened to detail what each connector is for.
3. Submit a product sheet for approval prior to purchase of the plates.
4. UTP Jacks shall be flush with the front of the plate
5. Provide custom plates for various audio and video inputs.
6. Plates shall be aluminum or steel.
7. Shall be custom plates or style-line style with stainless steel plates.
8. See drawings for description
9. Shall be Covid Brand or equal

B. Stainless Steel coverplate with Style-Line (GFI) opening
1. Single-gang plates shall be Hubbell #SS26
2. Double-gang plates shall be Hubbell #SS262

C. Brush opening plate
1. Where routing AV cables through an open backbox the contractor shall install a "brush" plate that covers the backbox and allows cable to pass thru
2. Provide a single or double gang cover plate with GFI openings.
3. Single-gang plates shall be Hubbell #SS26 with Leviton #41078-DBW, White in color or equal
4. Double-gang plates shall be Hubbell #SS262 with Two (2), Leviton #41078-DBW, White in color or equal

D. Style-line (GFI Rectangular) and 106 style inserts.
1. In addition to flush faceplates and surface housings, some installations call for integrated furniture outlets, GFI style outlets, and standard 106 style frames. These may be required at some surface raceway location. Field verify prior to ordering.
2. The Contractors shall identify which type of outlet or frame is required at each location throughout the system.
3. Match the outlet with the faceplate required.
4. GFI, more commonly referred to as style line outlets, are rectangular and fit in a rectangular plate used for GFI receptacles.
5. Each type of modular furniture has certain requirements for its voice and data modules. The Contractor shall coordinate with the furniture installer and provide the correct faceplate and outlets to match the color and style of the furniture.
6. The 106 style frame fits in a common duplex electrical receptacle faceplate. The frame holds 2 or 4 modular jacks.
7. For all connections that do not have a faceplate with a location for a laser printed paper label, the Contractor shall provide an engraved lamacoid label detailing the location number of each cable.
8. GFI/Style-line Plates shall be:

a. Hubbell
1) Two port, Hubbell # NS612W
2) Three port, Hubbell # NS613W,
3) Four port, Hubbell # NS614W
4) Six port, Hubbell # NS616W.
5) Blank, Hubbell #NS620W

9. 106 style plates shall be
a. Hubbell
1) Two port, Hubbell # BR106W
2) Four port, Hubbell # Q106OW

2.04 SURFACE MOUNT BOXES

A. Provide surface mount boxes for termination of cables as shown on the drawings.
1. Install a surface mount box at location for termination of the modular jacks.
2. Hubbell Part numbers.
a. One port surface box shall be Hubbell #HSB1BK.
b. Two port surface box shall be Hubbell #HSB2BK
c. Four Port Surface box shall be Hubbell #HSB4BK

2.05 AUDIO CABLING

A. Audio Cables
1. Cable to be used for connection of the Audio between devices.
2. Cables in the ceiling shall be plenum rated.
a. Where noted the audio shall be terminated onto the back of a connector at the faceplate.
b. Coordinate cable terminations with the devices to which they will connect.
c. Label each cable at each termination point for the device at the other end of the cable. Include port number.

B. Speaker Wire:
1. The Contractor shall size the speaker wire for the distance between the amplifier and the speaker, as well as the impedance of the speaker.
2. Speaker wire resistance shall not exceed 7 percent of the speakers' impedance.
3. Speaker wire shall be no smaller than 18 AWG.
4. Speaker wire shall be high conductivity, copper cable. Cable shall be of single pair, stranded construction. Cable shall be 2 parallel cables, black in color and 1 of the conductors shall be marked for identification at each end.
5. Cable shall be a minimum of 99.95 percent copper.
6. Provide plenum rated wire when the cable will route through a plenum area. Contractor shall be responsible for identifying plenum areas.
7. Speaker cables for these systems shall be homeruns from the speaker to the terminal strip. There shall be no splices in the cable.
a. 18 AWG plenum Speaker cable shall be West Penn #25224B or equal
b. 16 AWG plenum Speaker cable shall be West Penn #25225B or equal
c. 14 AWG plenum Speaker cable shall be West Penn #25226B or equal
d. 12 AWG plenum Speaker cable shall be West Penn #25227B or equal
e. 10 AWG plenum Speaker cable shall be West Penn #25210 or equal

C. Microphone bulk cable:
1. Microphone cable shall be for use with all types of microphones.
2. Each microphone cable to be terminated in the field shall have 4 conductors of which two are used for each terminal on an XLR connector.
3. Cable shall contain 4 stranded, 24 AWG conductors covered with a braided shield with a minimum of 75 percent coverage.
4. Microphone cable shall be yellow in color.
5. Microphone cable, Riser rated shall be Belden 1800B or equivalent.
6. Microphone cable, Plenum rated shall be Belden 1801B or equivalent.
7. All microphone cable shall be terminated with 3-pin XLR connectors. Connectors shall be Neutrik #NC3MX or equivalent.

D. Line Level Audio
1. To connect audio equipment at line level the contractor shall provide cables for connection.
2. Where bulk cable is used for phoenix style connectors the contractor shall provide single-pair stranded audio cable.
3. Microphone cable shall be 24 AWG (7x32) tinned copper
a. Overall Shield with 100% coverage
b. Plenum rated cable shall be Belden #1801B
c. Non-Plenum shall be Belden 1800B
d. Underground Audio line-level cable shall be Belden #5500F1

2.06 VIDEO CABLING

A. All cabling that is in a plenum rated area shall be plenum rated.
B. HDMI cables
1. Where cables route through a drop ceiling the cables shall be plenum rated.
2. Cables shall be of sufficient size to carry the signal over the distance required.
3. Cables to connect device to device shall be HDMI male to male.
4. At the locations where the cables route into devices at the desk or shelf the contractor shall provide short, flexible male to female cables.
5. Standard HDMI cables shall be no longer than 35’.
C. Active HDMI cables.
1. Approved manufacturers:
a. FSR
b. Legrand
c. Panduit
d. Hall Research
e. Cables 2 Go
2. Where the HDMI cable will be longer than 35’ the contractor shall provide Active HDMI cables or UTP/STP cabling and HDMI to CAT-6 transmitter/receiver.
3. Video Resolution shall meet or exceed:
a. HDMI resolutions up to 3840x2160 @ 30 (4K UHD),
4. HDMI Compliance: EDID, CEC HDCP2.2, HDMI 2.0
5. Audio Standards Supports PCM, Dolby, True HD, DTS-HD
6. Powered from HDMI output device or Thru USB connectivity at the display. (Ensure there is USB power at the display or provide a power brick)
7. All Active HDMI cables shall pass signal from Chromebooks/Laptops. Prior to ordering the Active HDMI cables the contractor shall test one cable with the owners Chromebooks.
a. If the contractor fails to test prior to ordering then they shall replace all active HDMI cables that do not pass the owners Chromebook/Laptop HDMI signals
8. Active Copper HDMI cables, Plenum shall be:
a. Legrand-Cables 2 Go or equal
1) 25’ Active copper HDMI Cable Plenum, Cables 2 Go # 42529
2) 40’ Active copper HDMI Cable Plenum, Cables 2 Go # 42531
3) 50’ Active copper HDMI Cable Plenum, Cables 2 Go # 42532
9. Active fiber HDMI cables, Plenum shall be:
a. FSR or equal: (No outside power required)
1) 10 Meter Active Optical HDMI Cable Plenum, FSR #18384
2) 15 Meter Active Optical HDMI Cable Plenum, FSR #18385
3) 23 Meter Active Optical HDMI Cable Plenum, FSR #18386
4) 30 Meter Active Optical HDMI Cable Plenum, FSR #18387
5) 46 Meter Active Optical HDMI Cable Plenum, Hall Research Javelin, #CHD-AP46
6) 60 Meter Active Optical HDMI Cable Plenum, Hall Research Javelin, #CHD-AP60
10. Active fiber HDMI cables, Mini-connector active HDMI cables for Small conduits.

a. These are combo fiber/copper cables that transmit HDMI signals
b. There are small connectors that can be used to pull thru conduits. Then apply the proprietary to HDMI caps after installation to connect devices.
c. Cables shall be ordered with correct length and shall be plenum rated
d. Cables shall be Hall Research #CHD-DExx where xx is the length.

2.07 USB CABLING

A. USB faceplates
1. Where noted on the drawings, provide USB pass thru plates with pigtails.
B. USB cables
1. For connection of devices provide USB-A male to USB-A male cables.
2. For extension of USB cables, provide USB-A male to USB-A female cables
3. Where required, provide USB cables that have USB-A male and USB-B male connectors
4. For extension of USB signals more than 20’ the contractor shall provide Active USB cables and connectors that meet USB 3.0 requirements
a. Active USB cables can be Type A/B connectors or Type C connectors with Adapters to fit and connect the devices at each end.
b. Active USB cables shall be Hall Research 3.0 /3.1 Javelin type cables or equal
1) Shall support legacy USB connectivity of 1.1 and 2.0

2.08 PATCH CABLES

A. Contractor shall provide all patch cables and gender changers required for a complete system.
B. Provide all flexible connections for video HDMI connections where required to connect to a device and the long-distance HDMI cable is not flexible enough.
C. All patch cables between devices that hard-wire between devices shall be labeled at each end detailing which device they connect to at the other end.
D. Provide tabletop and device side patch cables for connection of all devices at the conference room tables etc.
E. Patch cables shall be provided at each faceplate or tabletop device and all connections at the plate. Shall be no shorter than:
1. 8’ for top of table connection to table mounted plates
2. 15’ for connection from table to wall mounted plates.

2.09 CONTROL PANEL FOR BASIC VIDEO SYSTEMS

A. Basic presentation controller
1. Where noted provide a button panel that includes a control system. Integrate this control panel to the AV system for control of items shown.
2. The button panel shall meet the following:
a. (6 or 8) Assignable pushbuttons with interchangeable pre-labeled button caps, support macros
b. Shall be supplied with buttons that are labeled with icons for Power On, Power Off, Power Toggle, Volume Up, Volume Down, Mute, DVD Player, Generic Source, Computer 1, and Computer 2, plus set of 3 unlabeled
c. Provide custom engraved buttons when noted on the drawings.
d. Communications and connectors
1) 1-Ethernet: On an RJ–45 female connector for device configuration, control and firmware upgrade
2) 2 -RS-232: On 3–pin terminal block connectors
3) 1 -RS-485: On a 3–pin terminal block connector
4) 1 -K-NET: On a 4–pin terminal block connector
5) 2 -Relays: On 2–pin terminal block connectors (30V DC, 1A max)
6) 1 -GPI/O: On a 2–pin terminal block connector
7) 1 -Mini USB: On a female mini USB–B connector for configuration and firmware upgrade
e. Power to the device

1) Source: 12V DC 2A power supply. Provide a power supply and wire from the back of the display.

3. Button panel shall be Kramer #RC-206 Controller or equal

2.10 CABLE INSTALLATION TOOLS

A. Cable covering Nylon Mesh
   1. To connect the faceplate on the wall to the desk or cabinet or other device install a flexible, semi-rigid, split braid.
   2. Install all AV and data cables thru through a nylon mesh cable cover.
   3. Mesh cover shall be flexible and shall be tie wrapped to the cables at each end.
   4. Nylon Mesh shall be Tech Flex #F6Nx.xx series or equal.
   5. Shall be White at the projector, black as it transitions from wall to desk or lectern.

B. All cables shall be supported in the ceiling a minimum of every 5 feet. Support can be provided by installing cable inside cable tray or conduit, or by installing J-hooks every 5 feet.
   1. J-hooks shall provide a smooth steel or plenum rated plastic, support for cables as they route through the ceiling.
   2. Steel supports shall have a galvanized finish.
   3. Steel, UL listed, ultimate static load limit 50 pounds rated to support Category 5e and higher cables, and optical fiber cables.
   4. If required, assemble to manufacturer recommended specialty fasteners, including beam clips and flange clips.
   5. Acceptable products shall be:
      a. CADDY #CAT HP series with retainer hooks.
      b. CADDY #CAT-CM SERIES
   6. Provide with interfaces and clamps required to support J-Hooks from the building structure.
   7. Provide threaded rod and associated hardware required to support all J-Hooks

C. Firestopping shall be completed inside and around all conduits after cable installation. Firestop for the area between the cable and the edge of the conduit shall be Nelson No. FSP, CLK or LBS+. Contractor shall install the best firestop for each individual installation.
   1. Firestop shall be installed with regard to local and national building codes.
   2. The firestop shall be a putty like substance that expands under heat and will not allow flame to pass for a designated period of time.
   3. Firestop shall conform to all NEC, NFPA, and UL requirements.
   4. Some wall pass-thru's are shown on the drawings. The Contractor shall utilize these where possible.
   5. Where the contractor must install cables through a wall where there is no pass-thru already provided, the Contractor shall be responsible for installing a fire-rated pass-thru and fire-stopping the conduit after cable installation.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine all pathways prior to installation of all cables.
   1. Identify locations of all user conduits and backboxes prior to cable installation.
   2. Walk thru the building during construction and identify all boxes
   3. Coordinate installation of height of all boxes with the raceway installer.

3.02 PREPARATION

A. Locate main path for all cables and install J-hooks where cable tray is not provided.
B. Coordinate with other trades to install a clear, straight path down major corridors for the routing of user cables back to the communications closet.
C. Meet with construction manager to understand timing of ceiling grid and drop ceiling tiles.
D. Meet with electrical contractor to understand power installation schedule.

3.03 AUDIO AND VIDEO CABLE INSTLLATION

A. All AV cabling shall be installed according to TIA/EIA 568 standards, including all updates and addenda.
   1. When installing AV cables, care shall be taken to avoid crimping or bending the cable past the manufacturer's recommended bend radius.

2. During installation, the cables shall not be pulled across the ceiling tiles or the structure of the building. This may cause damage to the cable jacket.
3. Adhere to all pulling tensions and bend radii during installation. Excessive pulling or bending can cause the cable to fail tests after installation. Any cable that does not pass the intended signal after installation shall be fixed or replaced at the Contractor's expense.
4. All cables shall route neatly in the ceiling. Whether they route in cable tray or J-hooks, the cables shall be neat and orderly.
5. Install J-hooks and other cable supports to support all cables for the AV systems.
   a. In Gyms and cafeteria's, the contractor shall hide the speaker cable in the building steel whenever possible.
6. Support all cables at a minimum of every 5 feet.
7. Provide a short coil of extra cable where the cable enters the vertical conduit. The coil shall consist of no less than 1-1/2 feet.
8. Provide enough slack in the backbox, to fully remove the faceplate and jack and allow work to be done on the cable.
9. When installing cables in the communications room and AV cabinets, all cable shall route neatly through the cable tray and cable ladder and along the side of the cabinets.
   a. Install cable routing panels in the cabinets and racks where required.
10. When transitioning from the ceiling area to the rack or cabinet, all cable shall route through conduits or be attached to vertical section of cable ladder.
    a. The Contractor shall provide the conduits shown and any additional conduits or cable ladder required to neatly transition cables from the ceiling to the rack.
11. Cables shall route down each side of a rack for termination. Split each panel into 2 sides.
12. All speaker cables shall be terminated on a terminal strip.
    a. Attach this terminal strip to the wall or to a panel in the rack/cabinet
    b. Identify each speaker cables at the terminal strip and on each side of the strip
    c. Install patch cables from terminal strip to the amplifiers. Label the speaker cable at the amplifier
13. When terminating cables, ensure that the smallest amount of jacket is removed from the final termination point of the cables.
14. Provide a service loop of the cables on the wall or to side of cabinet. The loop shall extend no less than 1 foot below the termination point on the patch panel. Route the cables 1 foot below the device, and then back up to the device. This will provide room for future moves and additions to the rack.
15. Each cable shall have a self-adhesive, self-laminating, laser printed label at each end. The label shall show the device the cable attached to.
    a. Labels shall be installed no more than 4 inches from the termination point of the cable.

3.04 FACEPLATE/CUSTOM PLATE INSTALLATION

A. Faceplates/custom plates shall be mounted straight and level with the floor and walls of the building.
   1. Jacks and/or connectors shall be terminated to the appropriate cable and inserted in the correct orientation into the faceplate prior to the mounting of the faceplate.
   2. Each connector shall have a laser-printed or engraved/painted label detailing what it connects to.
   3. Cable slack shall be stored behind the faceplate in such a way that allows the minimum bend radius of the cables to be maintained as per the following:
   4. Care shall be taken when mounting the faceplate to avoid crimping or kinking the cables.
   5. Equip with all connectors and pass thru's shown on the drawings.
   6. Provide a cutsheet on the custom plates as part of the submittal process. Get designer approval prior to ordering and labeling.

B. Custom panels in racks

1. Where noted the contractor shall provide a custom panel in the rack or cabinet to support the cables and inputs shown.
2. Equip the panels with the control faceplates and/or input and output connectors.
3. Label each input and output and control plate with a phenolic label for detailing the device that this connects to. Shall include port number or input number on devices.
4. Provide a cutsheet on the custom panels as part of the submittal process. Get designer approval prior to ordering and labeling.

3.05 PATCH CABLE INSTALLATION

A. The contractor shall provide and install all patch cables and gender changes and baluns as required for complete system connectivity.
B. Install patch cables from the table or floorbox to the tabletop for connection of the systems.
C. Provide and install any DVI or Display port to HDMI devices for transmission of the AV signals
   1. Connect each device to the plate or other device with patch cables and interconnection cables.
   2. Keep all patch cables short where possible unless otherwise noted on the drawings. Large coils of extra patch cables are not required.
   3. Where there are two of the same type of cables routing to one device, provide different color cables or provide different color tape at each end of each cable.

3.06 CONTROL PANEL

A. The control panel shall be installed as shown on the drawings. Provide all the appropriate push buttons in the plate.
B. Meet with the owner to determine the sequence of how the control panel should work and what it shall control.
C. Install all cabling and sensors/devices required to transmit the signal and control the devices that are to be connected.

3.07 CABLE MESH

A. Nylon Mesh.
   1. At each lectern location, the contractor shall install the patch cables between the wall faceplate and the lectern inside a mesh cable sleeve.
   2. At the projector install the cables from the backbox or drop ceiling through the mesh. Match color of wall when possible.
      a. The contractor shall route all cables through the nylon mesh. This includes all data and AV cables.
      b. Install the power cable inside the mesh.
      c. Tie wrap the nylon mesh at each end.

END OF SECTION 28 5470

SECTION 28 7200 – TECHNOLOGY SUBMITTALS

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. This section provides the Contractor with requirements regarding Product Data Sheets, Shop Drawings and Product Samples collectively referred to as “Submittals”.

B. This section provides the Contractor requirements regarding As-Built Documentation after installation and prior to Final Completion and Final Payment

C. The requirements of this section deal only with those submittals that are required to be provided by the chosen contractor after bid award. No submittals in this section are required to be provided with the Bid Response.

D. The requirements contained herein should be considered bound and apply to all technology and security specification sections per this contract.

1.02 PRE-INSTALLATION SUBMITTALS

A. The contractor shall provide material submittals to the Construction Manager or directly to the designer, whichever is managing the project.

B. Prior to beginning work, the chosen Contractor shall provide PDF files of all material submittals.

1. Highlight the part number of each item specifically. Submittals that are not highlighted will be rejected and sent back immediately.
2. Match camera submittals with the camera type on the drawings. see Security Equipment Schedule on TC501. Provide marking on the PDF File detailing which camera type is being submitted.
3. Provide the PDF with the following file names
   a. Site - Spec Section - Description
   b. In Example: K**ent City 28 1600: Data Cabling submittal**

1.03 AS-BUILT DOCUMENTATION

A. The contractor shall provide As-Built documentation to the Construction Manager or directly to the designer, whichever is managing the project.

B. Provide the As-Builts in hard and soft copy

1. Hard Copy shall include all Red-lined Drawings showing what was actually installed and where it was installed.
2. Soft copy on USB Drives (PDF or Microsoft Word or Excel) shall include all documents provided in the hard copy plus any configuration or data files. Include XLS files for all spreadsheets.

PART 2 - PRE-INSTALLATION SUBMITTALS

2.01 PRODUCT DATA SHEETS

A. Product data sheets shall consist of the manufacturers detailed specification sheets or “cut-sheets” for each product that is to be installed by the contractor or any subcontractors.

B. Product data sheets shall minimally include, but shall not be limited to:

1. Part Number
2. Manufacturer
3. Description of the product
4. Physical dimensions and characteristics of the product
5. Picture or manufacturers drawing of the item, where applicable
6. Electrical characteristics of the product including heat-load for active electronics.
7. Optical characteristics of the product for Fiber-Optic equipment and cable.

C. Provide product data sheets for all equipment and cabling that is to be installed by the contractor

D. Provide a PDF of all the Equipment being submitted. Each actual part number shall be highlighted on the PDF in yellow.

1. Group Product Data Sheets by:
   a. Data Cabling
   b. Fiber Optic cabling
   c. Access Control
   d. Video Security

e. Audio and Video Systems

2.02 SHOP DRAWINGS

A. Shop Drawings shall consist of detailed drawings showing actual connectivity, equipment to be installed and cable types for the systems noted below:
   1. Specialty AV system one-line connectivity. Fieldhouse and Weight Room
B. Shop drawings shall also be provided for systems that the contractor intends to connect differently than what is shown on the contract drawings or where no connectivity is shown.

2.03 PRODUCT SAMPLES

A. Product Samples shall consist of a sample of the actual product that is to be installed.
B. Samples shall be tagged with the part number and specification section to which it pertains.
C. Product Samples shall be provided for the following:
   1. None at this time.

2.04 SUBMITTAL DOCUMENTS

A. The Contractor shall provide all Submittals to the Construction Manager or the designer
B. The Contractor shall provide PDF Files for all Product Data Sheets.
   1. All Product Data sheets shall be PDF files grouped as shown in 2.01/D
   2. The Contractor shall highlight the actual part number on the sheet of the component that they are submitting.
   3. If no part number is highlighted or marked with an arrow, then the entire submittal package will be rejected and sent back for re-submission.
C. The Contractor shall provide 1 set of PDF of Shop Drawings.
   1. Shop drawings shall be marked for the specification section of the bid documents to which they pertain. Mark the Detail (TCXXX/Y) to which the Shop Drawing refers.
   2. All shop drawings that are required to be drawn on the building background shall be provided on full-size drawings the same scale as those in the bid documents.
   3. All lines on the shop drawings shall be highlighted or completed in ink that is not the same color as that provided in the bid documents.
   4. The contractor shall provide a drawing legend detailing all symbols used in creation of the shop drawings.
D. The Contractor shall provide one of each product sample required to be submitted.
   1. Provide a cutsheet with each product sample detailing the specifics of the product and what it is proposed to be used for.

2.05 SUBMITTAL REQUIREMENTS

A. Submittals shall be provided for approval prior to installation of the work.
B. Any equipment installed that does not have an approved submittal associated with it can and will be removed from the project and replaced with other equipment as defined by the Designer. All replacement costs shall be the responsibility of the Contractor.
C. It shall be the responsibility of the Contractor to provide the submittals for review in sufficient time to not delay the installation. Work with the Construction manager on the schedule.
D. It shall be the responsibility of the contractor to ensure they have provided and have on hand “Reviewed” or “Furnish as Corrected” submittals for all equipment they install.
E. When reviewing submittals marked “Furnish as Corrected” take into account the comments and incorporate the comments into the products and installation of the systems.

PART 3 - AS-BUILT DOCUMENTATION

3.01 MATERIALS

A. The Contractor shall provide the following to the Designer prior to the issuance of the final payment.
   1. Approved submittals and equipment user manuals.
   2. As-Built Documentation as detailed below.
   3. All spare parts and cover plates for all components of the systems
   4. Manufacturer warranty cards for all components.

3.02 AS-BUILT PROCESS

A. The Contractor shall provide all project as-builts to the designer at substantial completion.
   1. Provide them to the designer for review
   2. Make any required changes the designer requests

3. Re-submit at the time of Final Completion / final payment. Final Payment is not possible without a complete post installation deliverable package

3.03 PREPARATION

A. All documents for As-Builts and test results shall be neat and clearly labeled with listing of the project and documents included in each binder.

B. Quantity:

1. Submit Red Lined, As-Built floorplans for the Systems detailed in 3.04/D.
   a. Provide one set of physical documents, full size,
   b. Provide PDF Scans of the As Built Floorplans.
2. Submit Electronic files for As-Built Documentation
   a. Provide PDF Files. Provide a Coversheet that details:
      A) Client name.
      B) Project name.
      C) Manual title (e.g., “Project Close-out Manual for security system upgrade”).
      D) Date; date format: <month> <day>, <year> (e.g., “January 1, 20xx”).
      E) Installer and General Contractor names and contact information
      F) Warranty contacts for all systems.
   b. Submit Electronic files to Owner, Designer and Construction Manager via email or dropbox or directly through USB Drives.
3. Submit (2) USB Drives with all As-Built documentation and software configurations.
   a. Software configurations shall be provided for:
      A) Video security NVR and camera/user database
      B) Access control system configuration and database
      C) AV systems configuration and touchpanel configuration

3.04 PROJECT DELIVERABLES

A. Provide a copy of all submittals and manuals and pamphlets.

B. Provide a copy of all Warranty documents and contact numbers for Warranty requests.

C. The contractor shall provide one set of full sized as-built prints. Provide a PDF of the as-built prints on the USB drives or via Email or Dropbox.

1. Provide a clean set of the latest drawings with red lines marked for all field changes or bulletins. See above for systems to be included on the As-Built prints

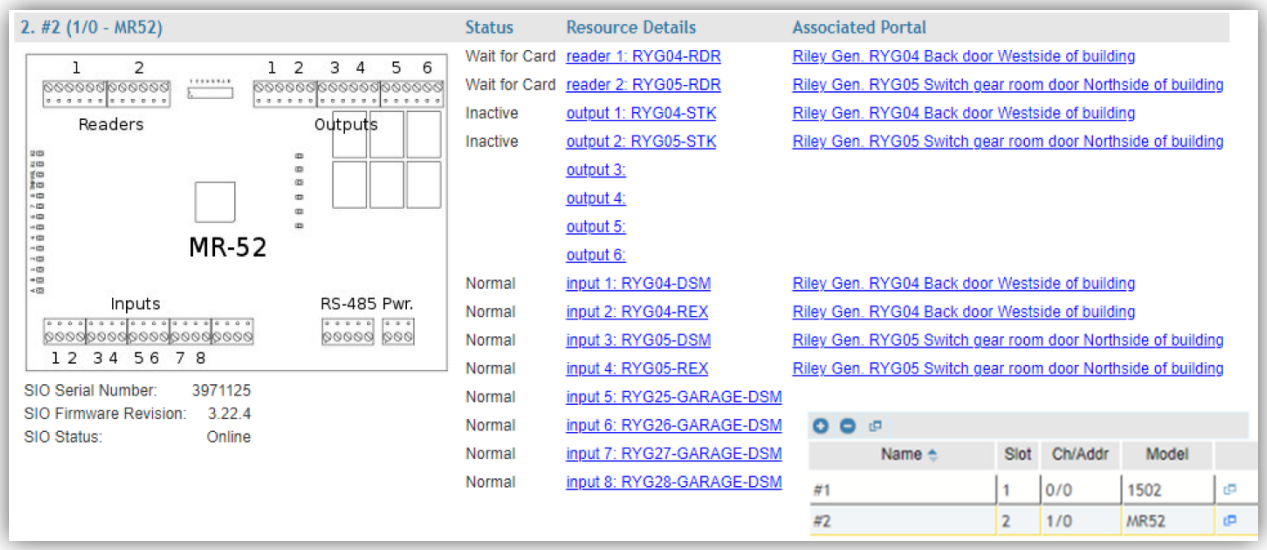
D. The As-Built drawings shall include:

1. Changes to be reflected on the drawings for Video Security Systems shall include:
   a. Camera locations
   b. Cabling Paths
   c. Camera numbers
   d. Comm room where camera connects to.
2. Changes to be reflected on the drawings for Access Control/Alarm Systems shall include:
   a. Changes to hardware installed at each door. Update each door for all devices installed and connected
   b. Changes to the panel locations
   c. Door numbers
   d. Changes to the schematic connectivity of any system shown on the drawings.
3. Changes to be reflected on the drawings for Audio and Video Systems shall include:
   a. Microphone/speaker faceplate locations and labels.
   b. Rack/cabinet locations.
   c. Speaker and microphone locations.
   d. Rack layout of all components in each rack.
   e. Changes to the schematic connectivity of any system shown on the drawings.
   f. Ceiling/wall mounted projector locations
   g. Label designation of all cables, including system interconnection cables.
4. Changes to be reflected on the drawings for Cabling Systems shall include:
   a. Route of exterior conduits and exterior cabling

b. Route of backbone cabling, fiber and copper
c. Route of major cable paths from outlet to comm room.
d. Rack/cabinet locations.
e. Faceplate locations
f. Rack layout of all components in each rack.
g. Changes to the schematic connectivity of any system shown on the drawings.
h. Cable numbering for each faceplate.

5. Changes to be reflected on the drawings for Paging and Clock System shall include:
   a. Clock Locations
   b. Microphone and audio input faceplate locations and labels.
   c. Rack/cabinet locations.
   d. Speaker locations and associated zone information for each speaker
   e. Primary cable routing paths
   f. Call button locations
   g. Label designation of all cables, including system interconnection cables.

E. Documentation for the specific systems shall include. Provide the following for each system:
   1. Contractor warranty dates based on Substantial completion date and contact information for warranty work.
   2. Data cabling
      a. Testing Documentation for copper and fiber cabling
         A) Include software to read the test results.
         B) Testing Documentation; This shall include actual cable test results. Tabbed Sections in the binder:
            1) Telecommunication Horizontal Cabling Detailed cable test reports
            2) Telecommunications Fiber backbone cabling
            3) Summary report
      b. Signed Cabling Warranty from manufacturer
   3. Video Security
      a. Picture of focused and approved camera image labeled with the camera number and IP address
      b. Master user password list
      c. Spreadsheet of each camera that shall include:
         A) Camera Part number
         B) Firmware revision
         C) IP address
         D) MAC Address
         E) Camera Name
         F) Building where it is located
      d. Training “Cheat Sheet”
      e. Manufacturers Camera Warranty
      f. Server/NVR Warranty
      g. Manufacturer contact information for warranty work
      h. Software Upgrade Protection (SUP) warranty including end date
      i. Warranty certificate for all PC’s
   4. Access Control
      a. Part list/diagram for each access control panel. To include
         A) Panel name and IP address (if applicable)
         B) Doors which are connected to this panel
         C) Panel location. Building and room number
      b. Diagram showing which devices and doors that are attached to each panel. Diagram shall be something like below. Group in PDF document per panel. Label the document with building and panel number. Ensure panel in the field has corresponding panel number



c. Training “Cheat Sheet”
d. Server Warranty
e. Software Upgrade Protection (SUP) warranty including end date
f. Warranty certificate for all PC’s

5. Audio / Video Systems
   a. Warranty certificate for LCD Monitors
   b. Warranty certificate for projectors

F. Training sign-in sheets detailing what was trained, who was trained and their time in training.

END OF SECTION 28 7200

SECTION 28 7600 – TECHNOLOGY LABELING

PART 1 - GENERAL

1.01 WORK INCLUDED

A. This section provides direction on labeling of cables and devices.

PART 2 - PRODUCTS

2.01 CABLE LABELING PRODUCTS INTERIOR

A. UTP/STP, access control and audio / video cabling
   1. Laser-printed, self-adhesive wrap around shall be Brady LAT-18-361 or equivalent.
   2. Label shall be 1.00-inch width x 1.33 inch high.
   3. Labels shall come on a sheet with 7 labels per row with a white and transparent matte finish.
   4. Sheet size shall be 8-1/2 inch x 11 inch.
   5. Printable area shall be a minimum of 1.00-inch width x 0.50 inch high.
   6. All labels shall be printed through a laser printer using labeling software.
   7. The Contractor shall submit a proposal for the labeling scheme for all audio and video wiring. The Engineer shall approve of the scheme prior to all labeling.

B. Wireless Access Point Cables in drop ceilings
   1. Install a yellow adhesive sticker to the drop ceiling grid at all WAP cables where the cable is coiled above a drop ceilng.
   2. Size to fit on the ceiling grid. Shall be yellow with black words. See below:
   3. **WAP CABLE ABOVE**

C. Audio and Video Components in a cabinet or rack or teacher desk/lectern.
   1. Each of the audio and video components shall be labeled.
   2. The labels shall have a white background with black, laser printed letters.
   3. Each label shall be large enough for 2 lines of text and wide enough to detail what each dial and component is for.
   4. Each input and output control point on the amplifiers and other equipment shall be labeled for the device to which it connects.
   5. Mark each volume or level control for the optimum setting.
      a. Put a mark at the nominal input and output level for each control. This shall be useful for a new person to reset the system to work as designed if someone else has changed the settings.

D. Fiber Cable labeling.
   1. Laser-printed, self-adhesive wrap around labels for and fiber cables in the comm rooms and ay the back of the patch panels shall be Brady LAT-19-361 or equivalent.
      a. Label shall be 1.00-inch-wide x 3.167 inch high.
      b. Labels shall come on a sheet with 7 labels per row with a white and transparent matte finish.
      c. Sheet size shall be 8-1/2-inch x 11 inch.
      d. Printable area shall be 1.00-inch-wide x 0.97 inch high.
      e. All labels shall be printed through a laser printer using labeling software.
      f. Install on fiber cable at the patch panel as it enters and at the coil of fiber on the wall or in the cable ladder
   2. Fiber panel labels
      a. All fiber optic patch panels shall be equipped with an adhesive, engraved lamacoid label that shows the type of fiber cable, quantity of strands and far end termination point.
      b. Label shall also detail which comm room the fiber originates in.
      c. Example is below:
      d. 

e. 

f. Where required, provide a blank SFP module to mount the label.

3. Interior exposed fiber cable and fiber cable inside inner duct shall be labeled every 100 feet, label shall be Panduit No. PST-FO.
   a. Label shall be covered with a clear laminate to protect the legend of the label.
   b. Attachments for tie wraps shall be available on the label to attach it to the cable or inner duct.

E. Faceplate Labels
1. Laser-printed, paper labels shall be used to label user faceplates.
2. Individual paper labels shall be installed behind the clear plastic strips of all user faceplates and surface mount housings.
   a. The labels shall show the location identifier number and letter of each individual cable.
3. Where a faceplate or surface mount box does not have a clear plastic strip the contractor shall install an adhesive label on the plate or surface mount box showing the cable number of each cable in the plate.

F. CAT-6/6A patch panels in comm rooms
1. Laser-printed, labels shall be used to label Cat-6 Patch panels
2. Label the side of the patch panel for the panel number in the comm room. “Panel A” etc. label on two spot on each panel
3. The panels shall be labeled 1-24. Use factory numbering or paper numbering if no factory numbering is provided.

G. Rack and Cabinet labels
1. Provide and install Engraved, lamacoid labels at the top of each rack or cabinet installed. Shall be black label with white engraved letters
2. Shall be 1” high minimum.
3. Coordinate rack number and comm room number prior to ordering
4. Sample:

a. 

H. Custom Faceplates
1. Engraved labels shall be installed at locations including but not limited to:
   a. Audio and Video special input plates. Detail each input and output
2. Size the phenolic labels for their individual uses. Provide a sample to the Engineer for approval prior to ordering or installation.

2.02 SECURTY CAMERA LABELING

A. Laser-printed, labels shall be used to label all Security Cameras
1. Label the camera with a White or Clear label with black lettering.
2. Label shall include the camera number.
3. May include the IP address. Consult with owner to determine if this is required
4. Label shall be a minimum of 3/4 inch tall and legible when standing beneath or near the camera as long as camera is not above 15; AFF

2.03 ACCESS CONTROL PANEL LABELING

A. Label the front of each access control panel to detail the doors that are connected to the panel.
1. Label the front panel and detail each door number
2. Label shall include the panel name and IP address

3. Text shall be a minimum of 3/8 inch tall
4. White label with black numbers

2.04 LABELING PRODUCTS EXTERIOR

A. Exterior fiber cable and fiber cable inside handholes, manholes and pullboxes shall be labeled.
   1. Label shall detail the type of fiber and strand count.
   2. Label shall detail the termination locations of the fiber cable. Include both building names and room numbers/descriptions.
   3. Label shall be covered with a clear laminate to protect the legend of the label.
   4. Attachments for tie wraps shall be available on the label to attach it to the cable or inner duct.
   5. Cable shall be Panduit # PST-FO.

PART 3 - EXECUTION

3.01 PREPARATION

A. Terminate all cables in proper color code sequence.
B. Clean any surfaces where an adhesive label is to be installed.
C. Prior to beginning the work, the contractor shall submit to the engineer a plan for labeling all the cables. This shall take into account to what components each cable is connected.

3.02 GENERAL LABELING

A. Everything shall be labeled as per the specs and drawings.
B. All labels shall be installed to more easily identify the cables and ports on all panels. If there are any questions regarding labeling, contact the Engineer prior to installation.
C. Engraved lamacoid labels shall be provided and installed whenever there is no location for paper inserts on faceplates, power poles, poke thru's, floor boxes, modular furniture and surface raceway.
   1. Engraved lamacoid labels shall provide the same labeling as the paper inserts, but they shall be self-adhesive.
   2. These labels shall be adhered to the location closest to the modular jack.
   3. Individual letters shall be provided for each cable. An overall location identifier can be provided for all the cables at that faceplate or floor box.
   4. Engraved labels for rack shall be at least 1-1/2 inch high with letters 1 inch high.
   5. These labels shall be affixed to the top and front of each rack or cabinet. Verify that the label will fit the rack or cabinet prior to purchasing.

3.03 DATA CABLING LABELING EXECUTION

A. Cable labels for CAT-6 user cables from the faceplate to the patch panel shall be installed within 4 inches of the end of the cable sheath.
   1. The location identifier is made up of 3 fields, and a sample might look like this:

      A-X-YY

      The A stands for the communications room where the cables are terminated.
      The X represents that the Patch panel in that comm. room.
      The YY represents the cables number in that panel 01-48.

      This system of identification provides the Owner with an easy way to keep track of cables, and where they are located or terminated.

   2. The cable label shall be similar to the label below:

A-X-YY
A-X-YY
A-X-YY

3. Provide a sample label to the Engineer for approval prior to installation of all labels.
4. Labels shall be installed at each end of each cable. Shall be within 4” of the termination.
5. Shall be at a uniform distance from termination on the patch panels. See pic below:

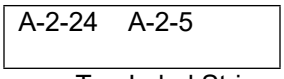






B. Paper inserts shall be supplied for all faceplates and patch panels labels.

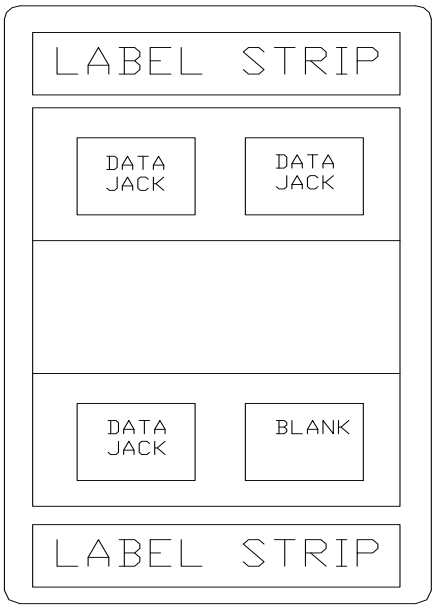
1. Paper inserts for the faceplate shall detail the exact location identifier for each cable.
2. They shall fully cover the background of the insert space on the faceplate, but all numbers and letters of the identifier shall be visible after installation of the plastic cover plate.
3. The paper insert for a standard faceplate will look like this:



Top Label Strip



Bottom Label Strip



4. Provide a sample label to the Engineer for approval prior to installation of all labels.

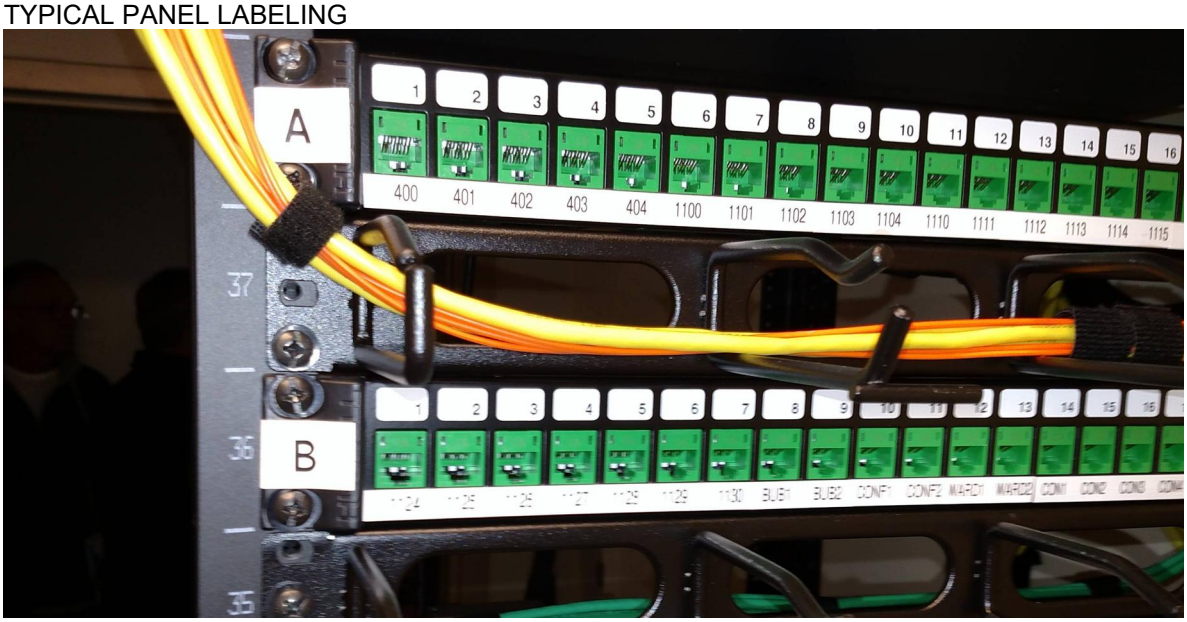
C. CAT-6 Patch panels shall be labeled for the panel they are numbered in the comm room and for the cameras (1-24 or 1-48)
1. See below diagram:
   a. Install labels at each end detailing the panel number.

Panel A	01	02	03	04	05	06	07	08	09	10	11	Panel A

D. CAT-6 Patch panels for Wireless Access Points shall be labeled for the WAP number
1. See below diagram:
   a. Install labels below each outlet on the patch panel detailing the WAP number
   b. Meet with the owner and obtain the WAP number and label the panel with that WAP number. Install .laser printed label
   c. Example below shows WAP number of BU (for Butler building)-0XX etc.

Panel A	01	02	03	04	05	06	07	08	09	10	11	Panel A
	BU-021	BU-022	BU-023	BU-024	BU-025	BU-026	BU-027	BU-028	BU-029	BU-030	BU-031	

TYPICAL PANEL LABELING



3.04 FIBER OPTIC CABLING LABELING EXECUTION

A. Fiber optic cables shall have a wrap around label at each end that details the 2 buildings and/or closets where the cables terminate.

1. A fiber cable with 12MM strands terminates in White Hall Room 012 and Green Hall Room 243. The wrap around label shall look like this:

12MM
WT 012-GR 243

2. The wrap around labels shall be installed within 12 inches of the end of the sheath of the copper and fiber cables.
3. Provide a sample label to the Engineer for approval prior to installation of all labels.

B. Label the fiber optic stowage ring with the information on the fiber cable

1. Provide a laminated label in the center of the fiber optic stowage ring that details each fiber cable and its fiber type, strand count and far-end termination of each fiber cable.

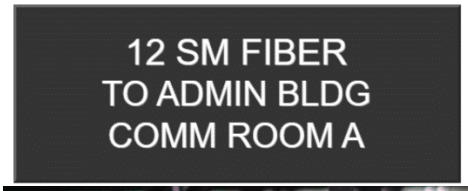
C. Fiber Panel labeling shall be done for the front of each fiber optic patch panel.

1. The figure below demonstrates the layout of the fiber panel label. Each label shall be customized for each individual panel. The figure below is for the 72 port panel.
2. Contact the Engineer with questions on the correct labeling prior to installation.

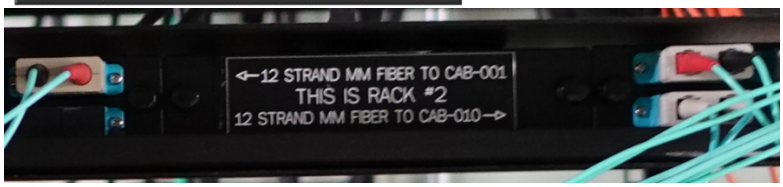
12 SM TO HIGH SCHOOL						12 MM TO COMM RM “B”						12 SM TO COMM RM “C”					
01	03	05	07	09	11	01	03	05	07	09	11	01	03	05	07	09	11
02	04	06	08	10	12	02	04	06	08	10	12	02	04	06	08	10	12

Figure A – Label for 36 Port Fiber Patch Panel

D. Fiber panel labeling shall be completed with an engraved plastic labels.
   1. Labels shall detail the fiber type, quantity of strand and far end termination building and comm room
   2. Sample:
      a.



      b.



3.05 VIDEO SECURITY LABELING

A. Cameras shall be labeled with the camera number in a visible location.
   1. Affix a label to the camera housing that details the camera number
   2. Shall be in a location that is visible from a standing position.
   3. Shall be laser printed.
   4. Label the camera cable patch panel to include the number of each camera connected to that cable. This camera cable label at the patch panel shall be by video security contractor
      a. Install an adhesive sticker below the cable in the patch panel as the factory number (1-24) is most likely on top of the panel.

B. Label the CAT-6 Patch Panel for security Cameras in each comm room
   1. Install an adhesive label on each port on the patch panel that attached so the security camera cable.

      DDD = the camera number within that building

C. CAT-6 Patch panels for security cameras shall be labeled for the camera number
   1. See below diagram:
      a. Install labels at each end detailing the panel number.

Panel A	01	02	03	04	05	06	07	08	09	10	11	Panel A
	101	102	107	108	201	105	208	145	146	147	174	

D. All labels shall be installed to more easily identify the cables and ports on all panels. If there are any questions regarding labeling, contact the Engineer prior to installation.

3.06 ACCESS CONTROL SECURITY LABELING

A. Security Panels shall be labeled on the outside to indicate panel number and communications room number

Security panel	IP address 111.111.10.112

Panel 04	Comm room XXX

1. Install a label on the inside of the panel that details:
   a. Door numbers that are connected to this panel
   b. Diagram of panel showing where each door is connected to the panel.
   c. Panel name as shown in the access control system
   d. IP address of the panel

B. Access Control cables shall be labeled.
1. The cables at the door devices shall be labeled where they connect to the device at the door
2. The cables at the panels in the communications rooms shall be labeled with the door number
3. Cable labels shall be installed within 3 inches of the end of the cable sheath.
   a. The cable label shall be similar to the label below:

125A-DC
125A-DC
125A-DC

   b. Provide a sample label to the Engineer for approval prior to installation of all labels.

125A-DC

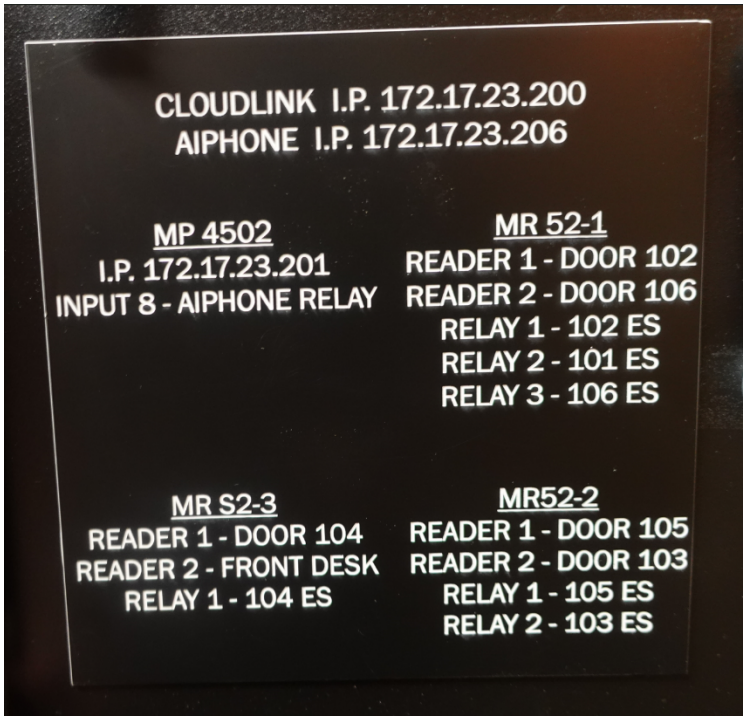
The 125A stands for the Door Number.
The DC stands for Door Contact. This could be any of the field devices: RX,ES, EL, MX, KP etc.

3.07 ACCESS CONTROL PANEL LABELING

A. PLC Panels shall be labeled on the outside to indicate panel number and communications room number

Security panel	IP address 111.111.10.112
Panel 04	Comm room XXX

1. Install a label on the inside of the panel that details:
   a. Door numbers that are connected to this panel
   b. Diagram of panel showing where each door is connected to the panel.
   c. Panel name as shown in the access control system
   d. IP address of the panel



2.
3. Shall be look like this and shall be phenolic engraved label.

3.08 AUDIO/VIDEO LABELING

A. The Contractor shall make up a spreadsheet listing each audio and video cable that extends from the cabinet/rack to a location within the building.
   1. The spreadsheet shall detail the number of the cable, the room it is located in, and the cabinet to which it routes.
   2. One line on the sheet shall show the results of the test. After being tested for continuity, and being tested that the cable delivers the required signal, the Contractor shall enter “PASS” into the result column.
   3. There shall be spaces for the name of the person doing the test, the date, and the company name.
   4. All information on the sheet shall be printed by a printer except the name of the person performing the tests, the date, and the “PASS” column.
   5. This spreadsheet shall be submitted to the Engineer and Owner prior to project completion.

B. Each control, audio, video, speaker, and microphone cable shall be labeled with a self-laminating, laser printed label at each end. This includes all interconnection cables.
   1. The cables shall be labeled for the equipment that the cable connects Consult with the Engineer prior to labeling.
   2. All speaker cables shall be marked according to their location in each room. Consult with the Engineer prior to labeling.
   3. Each video cable shall be labeled according to the equipment it connects to.
   4. The cable label shall be similar to the label below:

SPKR-1
SPKR-1
SPKR-1

a. The above label details that this cable is the first speaker cable for the audio system. The same rationale will be used for speakers, video cables, etc. The Contractor shall mark all as-built drawings to show the microphone location or speaker that the label refers to. There shall be continuity between all labels and as-built prints.
b. Provide a sample label to the Engineer for approval prior to installation of all labels.

C. Once the system is set up and running, many different people will be using the system. The Contractor shall label each audio and video component for what it does.
1. In example, the mixers shall detail what microphones they mix. Do this by labeling each gain control dial on the mixer. The mixer would be labeled as “Microphone-Mixer in Incident room” or other similar label.
2. For the description of all the components, consult with the Engineer. All labels shall be laser printed.
3. The Contractor shall identify each item on the as-built connectivity drawings. Use the same identification as you do on the labels.

END OF SECTION 28 7600

SECTION 28 7700 – TECHNOLOGY TESTING

PART 1 - GENERAL

1.01 WORK INCLUDED

A. This section provides direction on
   1. Testing of copper and fiber cable,
   2. Testing and commissioning of the technology systems

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Approved vendors for cable testers are:
   1. Fluke or equal

2.02 TESTING PRODUCTS

A. Category 6/6A cable shall be tested.
   1. Cable tester shall support Cat 6 channel and permanent link certification.
   2. Tester shall provide accuracy beyond TIA level III requirements traceable to laboratory reference standards.
   3. Through add on fiber optic probes, the tester shall be able to test multimode and single mode fiber cable.
   4. Test results shall be able to be stored on internal or removable compact flash memory cards.
   5. Tester shall have optional talk set for discussions over the cable being tested.
   6. Tester shall support a frequency range of 1-350 MHz with accuracy to the current proposed TIA Level III.
   7. Tester shall support the following tests:
      a. Near end crosstalk (NEXT).
      b. Attenuation.
      c. Equal level far end crosstalk (ELFEXT).
      d. Return loss.
      e. Ambiant noise.
      f. Wire map shall identify miswires, shorts, opens, reversals, and split pairs.
      g. Shall measure cable length and distance to faults (if any).
      h. Propagation delay.
      i. Loop resistance.
   8. Tester shall support the following test standards:
      a. TIA Cat 6 and ISO Class E.
      b. TIA Cat 5.
      c. TIA TSB-95.
      d. TIA Cat 3, 4 and 5 per TIA TSB-67.
      e. UTP, STP, SCTP coaxial and twinax cabling.
      f. IEEE: all Ethernet 802.3UTP and fiber PMD interfaces including 1000BASE-T; other 802.x PMD interfaces including token ring and demand priority.
      g. ATM: All UTP and fiber PMD interfaces.
   9. Tester shall have all required probes and accessories required to perform CAT-6/6A tests and “Network Tests.”
   10. Tester shall have been recently calibrated (within 4 months), and shall be utilizing the latest software.

B. Fiber Optic Tester:
   1. Fiber cable shall be tested with a light power meter.
      a. Multimode at 850nm and 1300nm, and single mode at 1310nm and 1550nm shall be tested by the light meter.
      b. Power meter testing shall have a range of +20 dBm.
      c. Testing at both wavelengths shall appear on the readout at one time for both multimode and single mode.
      d. All connector types shall be available for testing.
      e. Resolution of testing shall be to 1 foot.

2. All fibers shall be tested prior to any splice (other than pigtails) being closed and secured.

2.03 PUNCHLIST PROCESS

A. The contractor shall be required to go through a punchlist process prior to substantial completion and final completion/payment of each project

B. Contractor shall be responsible for reviewing their own work and checking to ensure it has met the project requirements.

C. The contractor shall:
1. Review your work in each room
2. Review the specifications and drawing and review their work to ensure it meets requirements
3. Create a punchlist document showing what work is not yet done and what as-builts are yet to be completed. Send document to designer.
   a. Provide a date when contractor punchlist work will be completed.
4. Schedule a punchlist and substantial completion meeting with designer.
5. Present updated punchlist document to the owner
6. Walk the site with the contractor and demonstrate all systems and review the work completed. Demonstrate how all work is completed

D. Designer will create an “Owner Punchlist” document
1. This will be provided to the contractor
2. Contractor shall review the list, fix/upgrade/replace all equipment and cabling and finish work on the punchlist
3. Return punchlist to the designer showing when the work was fixed/completed and a signature on the sheet showing that the contractor has reviewed each item.

E. Meet onsite with the designer to review the finished work.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Testing shall be completed after fiber is installed inside the fiber patch panel and the fiber panel has been put together.

B. All cables and panels where cables terminate shall be labeled with the cable label or name of each individual cable. Identify how each cable and panel will be labeled.

3.02 CATEGORY UTP/STP CABLE TESTING

A. Cable tests for CAT 6/6A cables shall be provided for each user CAT-6/6A cable.
1. Prior to beginning the testing, the Contractor shall provide the Engineer with a notice that testing will begin. Written notice shall be given at least 3 business days prior to testing beginning.
2. Tester shall be calibrated each day with manufacturer provided calibration cable.
3. Tests shall be saved under each cables unique location identifier.
4. Contractor shall provide the correct cables and probes specifically for the cable and modular jacks that are being tested.
5. During the test the tester shall be set to check all “Network Tests.”
6. Test results shall be provided in hard copy and soft copy. Along with the soft copy, provide a copy of the software required to read the test results.
7. Contractor shall supply 2 copies of the paper results and 2 copies of the file results.
8. Provide all paper results in 3-ring binders. Binders shall have a cover that shows the job name, job number, building and closet where the cables were tested, and the range in the location identifiers of the cables tests provided.
9. Tester shall be set to match the cable being tested.
10. Contractor is responsible for ensuring that all cables pass the tests. Any cable found not to pass shall be removed and replaced at the Contractor’s expense.

3.03 FIBER CABLE TESTING

A. Fiber cable shall be tested with a light meter for end-to-end tests.
1. Prior to beginning the testing, the Contractor shall provide the Engineer with a notice that testing will begin. Written notice shall be given at least 1 week prior to testing beginning.

2. Light meter tester shall be calibrated at the beginning of each day.
3. Light meter test results shall be provided in a spreadsheet format.
4. Contractor shall supply 2 copies of the paper results and 2 copies of the file results.
5. Provide all paper results in 3-ring binders. Binders shall have a cover that shows the job name, job number, building and closet where the cables were tested, and the range in the location identifiers of the cables tests provided. Test reports shall include the following information for each cabling element tested:
   a. Actual measured and maximum allowable attenuation (loss) at the specified wavelengths per Part 2, Section 3 and the margin. An individual test that fails the link criteria shall be marked as FAIL.
   b. Reference method.
   c. Number of mated connectors and number of splices (if any).
   d. Actual length and maximum allowable length per Part 2, Section 3. Any individual test that fails the link length criteria shall be marked as FAIL.
   e. Group refractive index (GRI) for the type of fiber tested, if length was optically measured.
   f. Tester manufacturer, model, serial number, and software version.
   g. Circuit ID number and project/job name.
   h. Link criteria (autotest) used.
   i. Overall pass/fail indication.
   j. Date and time of test.
6. Contractor shall test all user fiber cables to the following limits:
   a. Link attenuation shall be tested in accordance with ANSI/TIA/EIA-526-14A. Reference measurements shall be made in accordance with Method B or equivalent
   b. Multimode loss shall be no more than .6dB per mated connector and shall be no more than 3dB/km at 850nm and 1dB/km at 1300 nm.
   c. Singlemode loss shall be no more than .6dB per mated connector and shall be no more than .5dB/km at 1310 nm and .4dB at 1550 nm.
   d. If the measured loss is above the limits, the Contractor shall take action to fix the cables and get the tests to be below the loss limits.
7. Contractor is responsible for ensuring that all cables pass the tests. Any cable found not to pass shall be removed and replaced at the Contractor's expense.
8. Testing shall be of the optical link. An optical fiber link is defined as the passive cabling network between 2 optical cross connects (patch panels or outlets). This includes cable, connectors, and splices but does not include active components. The link test contains the representative connector loss at the patch panel associated with the mating of patch cords but does not include the performance of the connector at the equipment interface.

3.04 SECURITY SYSTEM COMMISSIONING

A. After all Work is completed, and prior to requesting the Acceptance test, Contractor shall conduct a final inspection, and pre-test all equipment and system features. Contractor shall correct any deficiencies discovered as the result of the inspection and pre-test.

B. Contractor shall submit a request for the Acceptance test in writing to the owner no less than fourteen days prior to the requested test date. The request for Acceptance test shall be accompanied by a certification from Contractor that all Work is complete and has been pre-tested, and that all corrections have been made.

C. During Acceptance test, Contractor shall demonstrate all equipment and system features to the owner. Contractor shall remove covers, open wiring connections, operate equipment, and perform other reasonable work as requested by the owner.

D. If the contractor has submitted all necessary paperwork and the system seems to be in working order according to the engineer then the system can be considered Substantially Complete after the engineer puts that in writing.

E. Security System Substantial Completion.
   1. The access control system shall be considered substantially complete as soon as:

a. All doors are connected, configured in the system and are working as required.
b. All security devices are connected and have been tested and shown to be fully functional. All cables are labeled at each end.
c. Intercoms are functioning and able to release lock on a door.
d. All users are entered into the system and all cards/fobs have been distributed.
e. All locking and unlocking schedules are defined and are working.
f. User accounts are setup
g. As-built drawings have been updated to reflect any changes in the connectivity.
h. All manufacturer literature has been turned over to the Owner.
i. Maps are setup and populated in the system.
j. Training has been completed.
k. Copy of the system configuration has been provided to the owner via a CD or thumb drive.

2. The video security system shall be considered substantially complete as soon as:
   a. All cameras are connected and functional.
   b. The system is fully configured and recording images as required.
   c. User accounts are setup
   d. As-built drawings have been updated to reflect any changes in the connectivity.
   e. All manufacturer literature has been turned over to the Owner.
   f. Maps are setup and populated in the system.
   g. Training has been completed.
3. The contractor shall schedule a substantial completion meeting where all security systems shall be demonstrated and shown to be in working order and configured as per the specs and the owner's requirements.
   a. If the system is deemed to be in working order then the engineer shall sign a letter stating that the systems are Substantially Complete. The system is not Substantially Complete until a letter is provided to the contractor and owner.
4. After substantial completion the systems shall be in good working order for a period of 30 days.
   a. In the event that the system or systems should fail or not work as required during the 30-day period, the Contractor shall be on site the same day to fix and configure the system to make it work as designed.
   b. A new 30-day period will begin as soon as the system has been demonstrated to be in good working order and the engineer acknowledges in writing that the system has been fixed and is again considered substantially complete.
5. Once the system has been considered Substantially Complete and has been working for 30 consecutive days with no interruption in service, the system shall be thought of as "Finally Complete."
6. Warranty shall begin immediately after the system is deemed Finally Complete.

3.05 AUDIO AND VIDEO SYSTEMS COMMISSIONING

A. Audio/Video System Testing
1. Notice of at least 1 week shall be given by the Contractor to the Engineer and Owner prior to the demonstration of all the audio and video components.
2. The Contractor shall provide a check off sheet of all the audio/video systems that will be demonstrated.
3. The video check off sheet shall include:
   a. Listing of all headend equipment.
   b. Listing of all the display equipment throughout the building.
   c. Listing of all the controls systems for the video.
   d. Include a short synopsis of the video system and the requirements for channels, viewing, switching, and control.
   e. There shall be space for the Engineer and Owner to check off that each feature has been demonstrated and has been shown to work. Additional space shall be provided at the bottom to note items that do not work or need to be fine-tuned.
4. The audio check off sheet shall include:

a. Listing of all specialty audio system in different rooms throughout the building.
b. There shall be space for the Engineer and Owner to check off that each feature has been demonstrated and has been shown to work. Additional space shall be provided at the bottom to note items that do not work or need to be fine-tuned.

5. For each system demonstrated, the Contractor shall show that each input is seen/heard through the output as required.
   a. Show that volume controls for each system actually do control the volume.
   b. Identify each piece of equipment and show the Owner its use.
   c. Test each video input and display throughout the entire system. Demonstrate connectivity to the CATV distribution system and show that the digital signage system is connected and working.
   d. Show that all channels are available as well as any internal input such as DVD players and video camera signals.
   e. Show that these systems can be controlled by a central control panel if the system is so equipped.
   f. Demonstrate connection of the desktop PC and audio to overhead projectors. And LCD displays.
   g. Demonstrate that each wired connection to the overhead projector works and demonstrate how to switch between inputs with the remote control.
   h. If a video switcher is installed, show its operation, and all its switching capabilities.
6. The check off sheets shall be provided to the Engineer prior to the day of the meeting for review. Any changes required by the Engineer shall be made before the sheet is handed out at the check off meeting.
7. Prior to the check off meeting, all the as-built drawings shall be updated with the latest field data. The as-built drawings shall be used to verify connectivity of all components. The Contractor shall also verify that all cable locations and audio/video components are connected as per the drawings.
   a. As-built drawings shall be available at the check off meeting for review by the Owner and Engineer.
8. As part of the as-built drawings, the Contractor shall provide a printed spreadsheet listing all the video and audio cables that route from a video or audio cabinet to a user location or display unit.
   a. The spreadsheet shall list the cable, the room it terminates in, and its identifying number. Refer to the testing specifications for further details.

B. Audio/Video System Substantial Completion.
1. The Audio/Video system shall be considered substantially complete as soon as:
   a. All systems have been shown to be connected and work as required
   b. All labeling is installed and systems are balanced.
   c. As-built drawings have been updated to reflect any changes in the connectivity.
   d. All manufacturer literature has been turned over to the Owner.
   e. Training has been completed.
2. The contractor shall schedule a substantial completion meeting where all AV systems shall be demonstrated and shown to be in working order and configured as per the specs and the owner’s requirements.

3.06 PAGING SYSTEM TESTING

A. Paging system testing:
1. The Contractor shall make up a spreadsheet that will be used for testing the equipment and connectivity in each room.
   a. List each room that has a separate zone. Room # and Zone extension #
   b. List each group zone and speakers in that zone.
2. Note each input to the system and an area for testing of that input.
   a. Telephone system integration with talkback if so equipped
   b. Music Integration for music player
   c. Desktop paging phone system

d. Desktop Microphone

3. The spreadsheet shall also list each zone and input and shall contain a space to note that each audio speaker was tested and that it passed the test.
4. Spreadsheet shall include space for noting who tested the speaker and the date of the test. All information on the sheet shall be printed by a printer except the name of the person performing the tests, the date, and the “PASS” column.
5. This spreadsheet shall be submitted to the Designer and Owner prior to project completion. Shall be submitted showing that each piece was tested.
6. Test Telephone interface to the paging system.
   a. Call into each separate classroom or paging zone and test audio
   b. Test talkback thru the telephone system.
   c. Document all zone numbers and call extensions.
7. Test music
   a. Play music in certain zones
   b. Play music during passing time
8. Test Bells
   a. Demonstrate bell tones. Change if the owner requests a change.
   b. Test that the bells are played through the speakers.
   c. If the system is deemed to be in working order then the engineer shall sign a letter stating that the systems are Substantially Complete. The system is not Substantially Complete until a letter is provided to the contractor and owner.

B. After substantial completion the systems shall be in good working order for a period of 30 days.
1. In the event that the system or systems should fail or not work as required during the 30-day period, the Contractor shall be on site the same day to fix and configure the system to make it work as designed.
2. A new 30-day period will begin as soon as the system has been demonstrated to be in good working order and the engineer acknowledges in writing that the system has been fixed and is again considered substantially complete.
3. Once the system has been considered Substantially Complete and has been working for 30 consecutive days with no interruption in service, the system shall be thought of as “Finally Complete.”
4. Warranty shall begin immediately after the system is deemed Finally Complete

3.07 CLASSROOM AV SYSTEMS

A. Classroom AV system testing:
1. The Contractor shall make up a spreadsheet that will be used for testing the equipment and connectivity in each room. There shall be a separate piece of paper for each room.
2. The spreadsheet shall include a list of the equipment in each room and the cables in each room. The contractor shall note the serial number of each of the active components on the spreadsheet.
3. The spreadsheet shall also list each connectivity point and shall contain a space to note that each audio and video connection was tested and that it passed the test.
4. Spreadsheet shall include space for noting who tested the connections and the date of the test. All information on the sheet shall be printed by a printer except the name of the person performing the tests, the date, and the “PASS” column.
5. This spreadsheet shall be submitted to the Engineer and Owner prior to project completion. Shall be submitted showing that each piece was tested.
6. After installation of all cables and components, the contractor shall test each cable and device to ensure that it works as intended.
   a. Test that the remote works for the projector.
   b. Test that the VCR, DVD and PC video images are able to be seen on the projector and on the projection screen.
   c. Test that the audio from each device is played through the speakers.
   d. If so equipped, connect and demonstrate the document camera.

e. Pull down the projection screen and note that the image from the projector fully fills the screen.
f. If the system is deemed to be in working order then the engineer shall sign a letter stating that the systems are Substantially Complete. The system is not Substantially Complete until a letter is provided to the contractor and owner.

B. After substantial completion the systems shall be in good working order for a period of 30 days.
1. In the event that the system or systems should fail or not work as required during the 30-day period, the Contractor shall be on site the same day to fix and configure the system to make it work as designed.
2. A new 30-day period will begin as soon as the system has been demonstrated to be in good working order and the engineer acknowledges in writing that the system has been fixed and is again considered substantially complete.
3. Once the system has been considered Substantially Complete and has been working for 30 consecutive days with no interruption in service, the system shall be thought of as “Finally Complete.”
4. Warranty shall begin immediately after the system is deemed Finally Complete.

END OF SECTION 28 7700

SECTION 28 7750 – TECHNOLOGY TRAINING

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. This section includes directions for the Contractor regarding training for technology and security systems.

1.02 SYSTEM DESCRIPTION

A. The Contractor shall provide training on all the installed systems.

PART 2 - PRODUCTS

Not used.

PART 3 - EXECUTION

3.01 GENERAL TRAINING REQUIREMENTS

A. The Contractor shall provide training on all systems installed or upgraded as part of the contract.
   1. The Contractor shall involve the personnel from the Owner's office in the implementation and configuration of the systems.
   2. Prior to the cutover of the system, the Contractor shall work with the Owner on the training that will be provided. The Owner and the Contractor shall schedule the training at a time beneficial to both.
   3. Each system is to have training provided as part of the installation.
   4. Each training session shall include.
      a. This training will give an overview of the capabilities of each system, and the methods to be employed in utilizing the system.
      b. The Contractor shall provide a syllabus detailing what will be discussed at the training, and notes for the Owner to refer to during the life of the system. The notes shall list directions for general use of the system and possible fixes to general issues that could occur.
      c. Training shall include as-built diagrams of the connectivity, a walk-thru of the system, a demonstration of actual user interface with the system, and directions on its general use.
      d. This training is only meant to give an overview of each system. In depth training shall be provided for an in-depth analysis of certain systems as described below.
   5. For all training, the Contractor shall pay all expenses.

B. Create cheat sheets for all systems that the users can keep after the training.
   1. Cheat sheet shall include details on how to use the system.
   2. A copy of the cheat sheet shall be laminated and installed at the system location.
   3. For individual training the contractor shall provide a cheat sheet for each person being trained.
   4. Cheat sheet shall be laminated.
   5. Provide a cheat sheet in each classroom or conference room.
   6. Submit these for approval to the designer and owner prior to training. Have the cheat sheets at the training.

3.02 AUDIO/VIDEO SYSTEM TRAINING

A. Training on the audio/video systems shall be as follows:
   1. Provide training on each type of System installed.
   2. Contractor shall provide a 2-hour in depth training class on the connectivity and use of each type of audio and or audio/video system.
   3. Training class shall be on-site utilizing the actual equipment installed as part of the system.
   4. The class shall be open to 6 of the Owner's Representatives.
   5. The Contractor shall provide handouts at the meeting detailing all aspects of the use of the system. It shall include directions on how to best utilize all components, as well as a checklist of items to go through if something is not working properly.
   6. The Owner and Contractor shall meet and decide on the syllabus prior to training.

7. Generate a laminated sheet detailing the sequence and how to use each system in each room. Leave that behind in the room. Provide extra paper copies to the owner.

3.03 LARGE SPACE AUDIO AND VIDEO TRAINING

A. Training on the audio system shall be as follows:
   1. Contractor shall provide two (2) training classes on the following systems:
      a. Fieldhouse
      b. High School Weight room
   2. Training class shall be on-site utilizing the actual equipment installed as part of the system.
   3. The class shall be open to 6 of the Owner's Representatives.
   4. The Contractor shall provide handouts at the meeting detailing all aspects of the use of the system. It shall include directions on how to best utilize all components, as well as a checklist of items to go through if something is not working properly.
   5. The Owner and Contractor shall meet and decide on the syllabus prior to training.
   6. The first training class shall be scheduled for 4 hours on-site and shall include a complete walk thru of each system. The contractor shall:
      a. Go through each piece of equipment and what it does. Show this piece of equipment on the as-built one line document.
      b. Demonstrate all inputs and outputs.
      c. Show all standard settings for controls on the systems.
      d. Review all control points.
      e. Review power connectivity and system on/off.
      f. Connect systems and inputs.
      g. Demonstrate level control and program changes to the systems
      h. Have the owner turn on the system and shut the system down.
      i. Go through labeling to demonstrate how all labels were numbered.
      j. Demonstrate DSP controls and the PC interface.
      k. Show how to setup wireless microphones
      l. Demonstrate how to setup assisted listening devices.
   7. The second training class shall be scheduled 4-6 weeks after the initial training class. This shall be scheduled for 3 hours on-site. The contractor shall:
      a. Ask if the owner has any questions and if they have had any issues since the last training. Address those issues/questions and demonstrate how the system is setup to work.
      b. Demonstrate all inputs and outputs.
      c. Show all standard settings for controls on the systems.
      d. Review all control points.
      e. Review power connectivity and system on/off.
      f. Connect systems and inputs.
      g. Demonstrate level control and program changes to the systems
      h. Have the owner turn on the system and shut the system down.
      i. Go through labeling to demonstrate how all labels were numbered.
      j. Demonstrate DSP controls and the PC interface.
      k. Show how to setup wireless microphones
      l. Demonstrate how to setup assisted listening devices.

B. The contractor shall be in attendance with one (1) technician for the first two events in this space(s)
   1. The contractor shall be on site for 3 hours at each event.
   2. The system shall be turned on and tested and the contractor shall assist with setup of all microphones and inputs.
   3. The contractor shall train all the owners people on how to setup the system and how to connect all microphones and aux inputs.
   4. Go through the entire process of turning on the system, setting all levels and choosing the correct program.

5. The contractor shall be on site with their own radios to immediately engage each other if there is a failure in the system.
6. Stay until the end of the event and help with tear down and shut off the system.

3.04 CLASSROOMAUDIO/VIDEO SYSTEM TRAINING

A. Training on the classroom audio/video distribution system shall be as follows:
1. Contractor shall provide a minimum of eight (8) -1 hour, in depth training classes on the connectivity and use of the classroom audio/video system. Each class shall be capable of having 12 teachers in the class.
2. Training class shall be on-site utilizing the actual equipment installed as part of the system.
3. Demonstrate all uses of the system and how it works.
4. The Contractor shall provide handouts at the meeting detailing all aspects of the use of the system. It shall include directions on how to best utilize all components, as well as a checklist of items to go through if something is not working properly.
5. The Owner and Contractor shall meet and decide on the syllabus prior to training.
6. Generate a laminated sheet detailing the sequence and how to use each system in each room. Leave that behind in the room. Provide extra paper copies to the owner.

3.05 PAGING/BELL SYSTEM TRAINING

A. The Contractor shall furnish pre-acceptance and post-acceptance training on the paging/bell system.
1. The first training shall occur during the on-site system configuration. 1 or 2 Owner’s Representatives shall be present when the technician is setting up the system and doing the programming of all the extension numbers and different call groups.
2. Formal training shall be done with Owner’s Representatives after installation and configuration of the system. The training shall include:
a. Copies of all pertinent paperwork and system booklets that come with the paging/sound masking system.
b. A spreadsheet listing all the speaker groups and their corresponding rooms and a drawing graphically representing the speaker groups.
c. The Contractor shall provide a short booklet detailing the steps required to perform all the general functions of the paging system.
d. A complete overview of the capabilities of the paging system and a demonstration of calling through the telephone system and desktop microphone shall be completed as part of the training.
e. At the end of the training, the administrators shall be able to fully configure and control all aspects of the paging systems.
f. All training shall take place on the Owner’s site with the Owner’s system.

END OF SECTION 28 7750

SECTION 28 7800 – TECHNOLOGY WARRANTY

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. This section includes directions for the Contractor regarding system and equipment warranties.

1.02 SYSTEM DESCRIPTION

A. The project is not complete until all paperwork has been provided.

1.03 COORDINATION

A. Coordinate as-built drawings and records with the Engineer and Owner.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Provide manufacturer's warranty for all equipment installed
B. Provide contractor warranty for workmanship and equipment
C. Provide software upgrade protection (SUP) warranty as detailed in the specifications.

2.02 MATERIALS

A. The Contractor shall provide the following to the owner/designer at Substantial Completion and any updates prior to the issuance of the final payment
   1. Manuals and pamphlets on all electronic equipment.
   2. All spare parts and cover plates for all components of the network.
   3. Red lined set of as-built drawings for the entire project.
B. Updated hard copy and soft copy of the As-Built Documentation. See associated spec section.

2.03 AUDIO-VIDEO ON-GOING SERVICE

A. The contractor shall provide scheduled service for each system listed below for a period of 15 months after substantial completion.
   1. Fieldhouse
   2. Weight Room in High School
B. The contractor shall be on-site for 4 hours with two technicians a minimum of two (2) times within 15 months after Substantial Completion.
C. The site visits shall tentatively be every 7 months and shall be utilized to answer any questions the owner has and fix/updated or change any portions of the system the owner has found is not working properly or wants to work differently.
D. At each site visit the contractor shall:
   1. Fully test each system and test all inputs and outputs.
   2. Test controls for on/off and program control.
   3. Clean all filters in cabinets and equipment.
   4. Check all labels and connectivity of equipment in the cabinets.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Contractor shall fully examine all components of the system to make sure that all manuals and paperwork are included in the final submittal.
B. Examine all equipment and cabling to ensure that it is labeled as per the drawings and specifications.

3.02 GENERAL WARRANTY

A. Warranty Period shall be One (1) years after a signed copy of Substantial Completion. This shall be the Warranty Period.
B. See further specifications for additional warranty requirements that may be longer for certain systems.
   1. Contractor shall be responsible for generating and submitting the Substantial Completion document to the designer for review and signature.
C. Warranty shall include each and every part, cable or software system provided as part of this project. This includes cabling, Networking, Wireless, Audio/Video systems and Access Control and Video Security systems.
   1. During the Warranty Period:

a. If any part is broken due to a manufacturing defect or installation defect, the Contractor shall fix and/or replace the broken item at their own expense.
b. If any equipment loses connectivity or fails for any reason the contractor shall be onsite to diagnose and fix or replace equipment and upgrades software.
c. The Contractor shall also supply all configuration and programming necessary to keep all electronic equipment to the latest revision of software during the warranty period.
d. If the “system” goes down, and needs configuration to be brought back up, the Contractor shall be liable for any programming or reconfiguration.
e. During the warranty period, the Contractor shall make the Owner aware of any software upgrades that are available.
f. Contractor shall install all software upgrades for that warranty period or as detailed below for specific systems.
g. If the system does not run well during the warranty period the contractor shall be onsite to diagnose and fix the system.

D. The contractor shall be onsite within 24 hours after a call from the owner or designer regarding system or equipment issues.

3.03 EXTENDED CABLING WARRANTY

A. The Contractor shall provide to the Owner a “Link Warranty” on all the components of the voice/data cabling system. This includes all components from the faceplate, through the jacks, cable, and back to the patch panels, not including patch cords.
1. This shall include Fiber Optic cabling and termination equipment.

B. Cable shall be installed that is covered as part of the complete warranty on the data cabling system. Cable that cannot be covered under the warranty shall not be installed.

C. The warranty shall be provided through the manufacturer of the faceplate, jacks, and patch panels. All components shall be by the same manufacturer.

D. The warranty shall guarantee that if any part or piece of the “Link” is found to be defective for a period of no less than 15 years, then that part or piece shall be replaced or fixed at no cost to the Owner.

E. The Contractor shall be responsible for installing the system in such a manner that the manufacturer will provide this warranty to the Owner.

F. The Contractor is responsible for compiling and submitting all the paperwork required to receive the warranty. This includes gathering all the information, completing any required forms, and submitting these forms and any other records to the manufacturer as required.

G. It shall be the Contractor’s responsibility to receive the approved warranty notification from the manufacturer and provide that and all the associated paperwork to the Owner.

H. The installation shall not be considered finally complete until the Owner has received notification, from the manufacturer, that the entire cabling system is covered by their warranty

3.04 AUDIO/VIDEO ON-GOING SERVICE

A. Entire Audio and Video system shall be warranted for 15 months

B. The contractor shall provide scheduled service for each system for a period of 15 months after substantial completion.

C. The contractor shall be on-site for 4 hours with two technicians a minimum of two (2) times within 15 months after Substantial Completion.

D. The site visits shall tentatively be every 7 months and shall be utilized to answer any questions the owner has and fix/updated or change any portions of the system the owner has found is not working properly or wants to work differently.

E. At each site visit the contractor shall:
1. Fully test each system and test all inputs and outputs.
2. Test controls for on/off and program control.
3. Clean all filters in cabinets and equipment.
4. Check all labels and connectivity of equipment in the cabinets.
5. Verify system works as installed.
6. Make any small configuration changes required by the owner.

3.05 SERVER WARRANTY

A. Each Server that is provided as part of this project shall be provided with a five-year (5) next day replacement warranty.
   1. The warranty shall include that the contractor be onsite and replace the server and any software required.
   2. Coordinate with the manufacturer to facilitate the server replacement.
   3. Re-install the server and connect to the network.
   4. Re-implement the existing owner's software and configure based on the final initial implementation.
   5. Keep a copy of the original configuration of the system to allow easy implementation of the new server.

3.06 CAMERA WARRANTY

A. All cameras shall be warranteed by the manufacturer for 5 years.

B. If camera fails during general warranty period than the contractor shall be onsite and replace camera with a new model. Install replacement camera.

C. After general warranty period the manufacturer shall replace or repair the camera if it fails.

3.07 VIDEO SECURITY SOFTWARE WARRANTY

A. As part of the project the contractor shall provide a three-year (3) video security recording system and security camera warranty that provides for all software updates during the years after Substantial Completion.
   1. Contractor shall be required to install all software and firmware updates during the three years.

3.08 ACCESS CONTROL SOFTWARE WARRANTY

A. As part of the project the contractor shall provide a three-year (3) access control system software warranty that provides for all software updates during the years after Substantial Completion.
   1. Contractor shall be required to install all software and firmware updates during the three years.

END OF SECTION 28 7800