PROJECT MANUAL

College of Arts and Sciences
Dean & Student Affairs Renovation

University of Rhode Island
142 Flagg Road
Kingston, RI 02881

January 11, 2019

BTGA #1801G
URI Job Number
KC.G.CHAF.2018.001

Owner: State of Rhode Island Board of Education, University of Rhode Island, and State of Rhode Island

In care of: Office of Capital Projects
University of Rhode Island
Sherman Building, 60 Tootell Road
Kingston, RI 02881

Design Agent: Brewster Thornton Group Architects, LLP
150 Chestnut St. Providence, RI 02903
Attn: Nathaniel Ginsburg, AIA, (401) 861-1600

Consultant: Wozny Barabar and Associates, Inc.
1076 Washington Street
Hamilton, MA 02339
(781) 826-4144

PROJECT MANUAL

Renovations for the Chafee Dean of Arts and Sciences Suite

University of Rhode Island
142 Flagg Road
Kingston, RI 02881

January 11, 2019

BTGA Job # 1801G
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DOCUMENT 00 5200 – AGREEMENT FORM

PART 1 – GENERAL

1.1 The Agreement Form to be utilized on this project is AIA Document A101-2017 as amended, a copy of which follows this page.

END OF DOCUMENT

AIA® Document A101™ – 2017

Standard Form of Agreement Between Owner and Contractor where the basis of payment is a Stipulated Sum

AGREEMENT made as of the date of issuance of the Owner's Purchase Order.

(Paragraph Deleted)

BETWEEN the Owner:
(Name, legal status, address, telephone and facsimile numbers, and website)

State of Rhode IslandOne Capitol Hill, Second Floor
Providence, Rhode Island 02908-5855
401.578.8100 (telephone); 401.574.8387 (facsimile)

acting by and through,
The University of Rhode Island Purchasing Department
10 Tootell Road
Kingston, Rhode Island 02881
401.874.2171 (telephone); 401.874.2306 (facsmilie)
http://web.uri.edu/purchasing/

and
Rhode Island Council on Postsecondary Education
560 Jefferson Boulevard, Suite 100
Warwick, Rhode Island 02886
401.456.6000 (telephone); 401.732.3541 (facsimile)

on behalf of the User Agency:
(Name, legal status, address, telephone and facsimile numbers, and website)

The University of Rhode Island
Office of Capital Projects
60 Tootell Road – Sherman Building
Kingston, Rhode Island 02881
401.874.2725 (telephone)

and the Contractor:
(Name, legal status, address, telephone and facsimile numbers, and website)

for the following Project:
(Name, location and detailed description)

The Design Agent:

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

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

The parties should complete A101™–2017, Exhibit A, Insurance and Bonds, contemporaneously with this Agreement. AIA Document A201™–2017, General Conditions of the Contract for Construction, is adopted in this document by reference. Do not use with other general conditions unless this document is modified.

Init.
/

(Name, legal status, address, telephone and facsimile numbers, and website)

The Owner and Contractor agree as follows.

(Paragraph Deleted)

The Owner and Contractor agree as follows.

TABLE OF ARTICLES

ARTICLE 1 THE CONTRACT DOCUMENTS

The Contract Documents consist of this Agreement, Conditions of the Contract (General Conditions, Supplementary Conditions (if any), and other Conditions), Drawings, Specifications, Addenda issued prior to execution of this Agreement, other documents listed in this Agreement, and Modifications issued after execution of this Agreement, all of which form the Contract, and are as fully a part of the Contract as if attached to this Agreement or repeated herein. The Contract represents the entire and integrated agreement between the parties hereto and supersedes prior negotiations, representations, or agreements, either written or oral. An enumeration of the Contract Documents, other than a Modification, appears in Article 9.

ARTICLE 2 THE WORK OF THIS CONTRACT

The Contractor shall fully execute the Work described in the Contract Documents, except as specifically indicated in the Contract Documents to be the responsibility of others. No part of the Work shall be performed by Subcontractors without the Owner's prior written consent.

ARTICLE 3 DATE OF COMMENCEMENT AND SUBSTANTIAL COMPLETION

§ 3.1 The date of commencement of the Work shall
be the later of: (i) the issuance of the Purchase Order by the Owner; and (ii) the
(Paragraph Deleted)

date set forth in a notice to proceed issued by the User Agency.

(Paragraphs Deleted)

§ 3.2 The Contract Time shall be measured from the date of commencement of the Work.

§ 3.3 Substantial Completion

§ 3.3.1 Subject to adjustments of the Contract Time as provided in the Contract Documents, the Contractor shall achieve Substantial Completion of the entire Work:
(Check one of the following boxes and complete the necessary information.)

[ ] Not later than ( ) calendar days from the date of commencement of the Work.

[ ] By the following date:

§ 3.3.2 Subject to adjustments of the Contract Time as provided in the Contract Documents, if portions of the Work are to be completed prior to Substantial Completion of the entire Work, the Contractor shall achieve Substantial Completion of such portions by the following dates:

Portion of Work	Substantial Completion Date

§ 3.3.3 If the Contractor fails to achieve Substantial Completion as provided in this Section 3.3, liquidated damages, if any, shall be assessed as set forth in Section 4.5.

ARTICLE 4 CONTRACT SUM

§ 4.1 The Owner shall pay the Contractor the Contract Sum in current funds for the Contractor's performance of the Contract. Subject to additions and deductions as provided in the Contract Documents, the Contract Sum shall be: $_____.

§ 4.2 Alternates

§ 4.2.1 Alternates, if any, included in the Contract Sum:

Item	Price

§ 4.2.2 Subject to the conditions noted below, the following alternates may be accepted by the Owner following execution of this Agreement. Upon acceptance, the Owner shall issue a Modification to this Agreement.
(Insert below each alternate and the conditions that must be met for the Owner to accept the alternate.)

Item	Price	Conditions for Acceptance

§ 4.3 Allowances, if any, are specified in the Bid Proposal Form and are included in the Contract Sum.

(Paragraph Deleted)

(Table Deleted)

§ 4.4 Unit prices, if
any, are specified in the Bid Proposal Form and include all costs, including without limitation, labor, materials, services, regulatory compliance, overhead, and profit necessary for the completion of the Work. Unit prices shall be used for both additions to, and deletions from the Work.

(Table Deleted)

§ 4.5 Liquidated damages, if any:
(Insert terms and conditions for liquidated damages, if any.)

.1 In the event that there is one date for Substantial Completion of the Work, the Contractor shall pay the Owner the sum stipulated in this Section 4.5.1 as liquidated damages, and not as a penalty, for each calendar day of delay until the Work is substantially complete: $_____.

.2 In the event that the Project is scheduled to be completed in phases, and there is more than one date for Substantial Completion of the Work, the Contractor shall pay the Owner an aggregate amount equal to the sums stipulated in this Section 4.5.2 as liquidated damages, and not as a penalty, for each calendar day of delay until the Work for each phase is substantially complete:

Phase	Liquidated Damages Sum

.3 The Owner and the Contractor have reasonably determined the sums set forth in this Section 4.5 to be a fair estimate of the Owner' actual damages which are difficult to ascertain in the event of delay.

§ 4.6 Other:
(Paragraph Deleted)

The Owner shall not be liable to the Contractor or any Subcontractor for claims or damages of any nature caused by or arising out of any delays. The sole remedy against the Owner for delays shall be the allowance of additional time for completion of the Work.

ARTICLE 5 PAYMENTS

§ 5.1 Progress Payments

§ 5.1.1 Based upon Applications for Payment submitted to the Design Agent by the Contractor and Certificates for Payment issued by the Design Agent and approved by the Owner in writing, the Owner shall make progress payments on account of the Contract Sum to the Contractor as provided below and elsewhere in the Contract Documents.

§ 5.1.2 The period covered by each Application for Payment shall be one calendar month ending on the last day of the month.

§ 5.1.3 The Owner shall make payment of the certified amount, less retainage, to the Contractor not later than the 30th working day following written approval by the Owner.

(Paragraph Deleted)

§ 5.1.4 Each Application for Payment shall be based on the most recent schedule of values submitted by the Contractor and approved by the Design Agent and the Owner in accordance with the Contract Documents. The schedule of values shall allocate the entire Contract Sum among the various portions of the Work. The schedule of values shall be prepared in such form, and supported by such data to substantiate its accuracy, as the Design Agent and the Owner may require. This schedule of values shall be used as a basis for reviewing the Contractor's Applications for Payment.

§ 5.1.5 Applications for Payment shall show the percentage of completion of each portion of the Work as of the end of the period covered by the Application for Payment.

§ 5.1.6 In accordance with AIA Document A201™–2007, General Conditions of the Contract for Construction, and subject to other provisions of the Contract Documents, the amount of each progress payment shall be computed as follows:

§ 5.1.6.1 The amount of each progress payment shall first include:

.1 That portion of the Contract Sum properly allocable to completed Work;

.2 That portion of the Contract Sum properly allocable to materials and equipment delivered and suitably stored at the site for subsequent incorporation in the completed construction, or, if approved in advance by the Owner, suitably stored off the site at a location agreed upon in writing; and

.3 That portion of Construction Change Directives that the Design Agent determines, in the Design Agent's professional judgment, to be reasonably justified.

§ 5.1.6.2 The amount of each progress payment shall then be reduced by:

.1 The aggregate of any amounts previously paid by the Owner;

.2 The amount, if any, for Work that remains uncorrected and for which the Design Agent has previously withheld a Certificate for Payment as provided in Article 9 of AIA Document A201–2007;

.3

For Work performed or defects discovered since the last payment application, any amount for which the Design Agent may withhold payment, or nullify a Certificate of Payment in whole or in part, as provided in Article 9 of AIA Document A201–2007; and

.4 Retainage withheld pursuant to Section 5.1.7.

§ 5.1.7 Retainage

§ 5.1.7.1 For each progress payment made prior to Substantial Completion of the Work, the Owner may withhold the following amount, as retainage, from the payment otherwise due: five (5%) percent.

(Paragraph Deleted)

§ 5.1.7.1.1
Deleted.

§ 5.1.7.2 Deleted.

(Paragraph Deleted)

§ 5.1.7.3 Except as set forth in this Section 5.1.7.3, upon Substantial Completion of the Work, the Contractor may submit an Application for Payment that includes the retainage withheld from prior Applications for Payment pursuant to this Section 5.1.7. The Application for Payment submitted at Substantial Completion shall not include retainage as follows:
(Insert any other conditions for release of retainage upon Substantial Completion.)

The amount of five (5%) percent shall be retained by the Owner until the first anniversary of final completion of the Work.

§ 5.1.8 If final completion of the Work is materially delayed through no fault of the Contractor, the Owner shall pay the Contractor any additional amounts in accordance with Article 9 of AIA Document A201–2007.

§ 5.1.9 Except with the Owner's prior written approval, the Contractor shall not make advance payments to suppliers for materials or equipment which have not been delivered and stored at the site.

§ 5.1.10 Within 10 working days of receipt of any progress payment from the Owner, the Contractor must pay its Subcontractors the full amount included for each such Subcontractor within the Contractor's Application for Payment in accordance with the provisions of AIA A201 – 2007, General Conditions of the Contract for Construction.

§ 5.2 Final Payment

§ 5.2.1 Final payment, constituting the entire unpaid balance of the Contract Sum, less the amount withheld pursuant to § 5.1.7.3, shall be made by the Owner to the Contractor when:

.1 the Contractor has fully performed the Contract except for the Contractor's responsibility to correct Work as provided in Article 12 of AIA Document A201–2007, and to satisfy other requirements, if any, which extend beyond final payment; and

.2 a final Certificate for Payment has been issued by the Design Agent and approved in writing by the Owner;

.3 the Contractor has submitted its final release and final releases from all of its Subcontractors and suppliers in a form acceptable to the Owner; and

4 the Contractor has submitted to the Owner all close-out documents, including without limitation, all as-built plans, warranties, manuals, and other materials set forth in the Contract Documents.

§ 5.2.2 The Owner's final payment to the Contractor shall be made no later than 30 working days after the issuance of the Design Agent's final Certificate for Payment and written approval by the Owner.

§ 5.3 Interest

Payments due and unpaid under the Contract shall bear interest from the date payment is due in accordance with the provisions of "Prompt Payment by Department of Administration," R.I. Gen. Laws §§ 42-11.1-1 et seq.

§ 5.4 Owner's Rights

§ 5.4.1 The Owner shall have the right to deduct from any payments due to the Contractor the amount of any unpaid obligations owed to the State of Rhode Island by the Contractor, including without limitation, any and all unpaid taxes, the amount of any claim against the
Contractor arising out of this Agreement, or any amount on account of any other reason permitted by applicable law.

ARTICLE 6 DISPUTE RESOLUTION

§ 6.1 Initial Decision Maker

Claims shall be referred to the Initial Decision Maker for initial decision. The University of Rhode Island Vice President for Administration and Finance pursuant to the provisions of the "Delegation of Limited Procurement Authority," dated January 19, 2018 and the provisions of the "State Purchases Act," R.I. Gen. Laws § 37-2-1 et seq., will serve as the Initial Decision
Maker in accordance with the provisions of the State Purchases Act, State of Rhode Island Procurement Regulations, and this Section 6.1. An initial decision shall be required as a condition precedent to binding dispute resolution pursuant to Section 6.3 of any Claim arising prior to the
date final payment is due.

§ 6.2 Mediation

For any Claim not resolved by the Initial Decision Maker procedures set forth in Section 6.1, and prior to the implementation of the binding dispute resolution procedures set forth in Section 6.3, the Contractor shall
have the
option to pursue mediation, exercisable by written notice to the Owner within 30 calendar days of an Initial Decision. In the event of the exercise of
such option by the Contractor, the Owner and the Contractor shall attempt to select a mediator, and in the event that the Owner and the Contractor cannot agree on a mediator, either party may apply in writing to the Presiding Justice of the Providence County Superior Court, with a copy to the other, with a request for the court to appoint a mediator, and the costs of the mediator shall be borne equally by both parties.

(Paragraph Deleted)

§ 6.3 Binding Dispute Resolution

For any Claim not resolved by the Initial Decision Maker procedures set forth in Section 6.1, or mediation at the option of the Contractor pursuant to Section 6.2, the method of binding dispute resolution shall be determined in accordance with the provisions of the "Public Works Arbitration Act," R.I. Gen. Laws §§ 37-16-1 et seq.

ARTICLE 7 TERMINATION OR SUSPENSION

§ 7.1 The Contract may be terminated by the Owner or the Contractor as provided in Article 14 of AIA Document A201–2007. The Contract may also be terminated by the Owner: (i) in the event of the unavailability of appropriated funds; (ii) in the absence of a determination of continued need; or (iii) as
otherwise provided in the State of Rhode Island Procurement Regulations General Conditions of Purchase or other applicable law.

§ 7.1.1 Deleted.

§ 7.2 The Work may be suspended by the Owner as provided in: (i) the State of Rhode Island General Conditions of Purchase Regulation or other applicable law; or (ii) Article 14 of AIA Document A201–2007.

ARTICLE 8 MISCELLANEOUS PROVISIONS

§ 8.1 Where reference is made in this Agreement to a provision of AIA Document A201–2007 or another Contract Document, the reference refers to: (i) the AIA Document A201 – 2007 or other Contract Document as modified by the Owner; and (ii) that provision in the AIA Document A201 – 2007 or other Contract Document as amended or supplemented by other provisions of the Contract Documents.

§ 8.2 Representatives for the Owner

§ 8.2.1 The Owner's representative:

(Name, title, address, email address, and other information for the preferred methods of contact)

The University of Rhode Island, Purchasing Department
10 Tootell Road
Kingston, Rhode Island 02881
Paul M. DePace, PE
401.874.2725 (telephone)

§ 8.2.2 The User Agency's representative:
(Name, title, address, email address, and other information for the preferred methods of contact)

The University of Rhode Island
Office of Capital Projects
60 Tootell Road – Sherman Building
Kingston, Rhode Island 02881
Paul M. DePace, PE
401.874.2725 (telephone)

§ 8.2.3 The Design Agent's representative:
(Name, title, address, email address, and other information for the preferred methods of contact)

§ 8.3 The Contractor's representative:
(Name, title, address, email address, and other information for the preferred methods of contact)

§ 8.4 Neither the Owner's nor the Contractor's representative nor the Design Agent's representative shall be changed without 10 working days' prior notice to the other party.

§ 8.5 Insurance and Bonds
§ 8.5.1 The Owner and the Contractor shall purchase and maintain insurance as set forth in the Solicitation and elsewhere in the Contract Documents.

§ 8.5.2 The Contractor shall provide bonds as set forth in the Solicitation and elsewhere in the Contract Documents.

§ 8.6 Deleted.

§ 8.7 Other provisions:
§ 8.7.1 The Contractor represents and warrants to the Owner, in addition to any other representations and warranties of the Contractor elsewhere in the Contract Documents:

.1 The Contractor and its Subcontractors are each financially solvent, able to pay their debts as they mature, and possess sufficient working capital to perform their obligations under the Contract Documents.

.2 The Contractor and its Subcontractors are each able to furnish the tools, materials, equipment, and labor required to complete the Project as required under the Contract Documents.

.3 *The Contractor and each Subcontractor are authorized to do business in the State of Rhode Island and are properly licensed by all necessary governmental authorities having jurisdiction over them and over the Work and the Project.*

.4 The execution of this Agreement and its performance is within its duly authorized powers.

.5 The Contractor has visited the site of the Project, familiarized itself with the local and special conditions under which the Work is to be performed, and correlated its observations with the requirements of the Contract Documents.

.6 The Contractor possesses the requisite level of experience and expertise in the business administration, construction, and superintendence of projects of the size, complexity, and nature of the Project, and it will perform the Work with the care, skill, and diligence of a contractor possessing such experience and expertise.

§ 8.7.2 The representations and warranties of the Contractor in this Section 8.7 and elsewhere in the Contract Documents will survive the execution and delivery of this Agreement, any termination of this Agreement, and the final completion of the Work.

§ 8.7.3 Any Change Orders or other Modifications must be approved in writing by the Owner.

§ 8.7.4 The Owner is the State of Rhode Island, acting by and through the University of Rhode Island Purchasing Department, and therefore, pursuant to the provisions of R.I. Gen. Laws § 34-28-31, mechanics liens may not be placed against the Project.

ARTICLE 9 ENUMERATION OF CONTRACT DOCUMENTS

§ 9.1 This Agreement is comprised of the following documents:

.1 AIA Document A101™–2017, Standard Form of Agreement Between Owner and Contractor, as modified by the Owner

.2 **Deleted.**

.3 AIA Document A201™–2007, General Conditions of the Contract for Construction, as *modified by the* Owner.

.4 **Deleted.**

.5 Drawings

(Table Deleted)

The Drawings are included in the Solicitation and are available on the Division of Purchases website at www.purchasing.ri.gov.

.6 Specifications

(Table Deleted)

The Specifications are included in the Solicitation and are available on the Division of Purchases website at www.purchasing.ri.gov.

.7 Addenda, if

(Table Deleted)

any, issued pursuant to the Solicitation form a part of the Solicitation and are available on the Division of Purchases website at www.purchasing.ri.gov.

.8

Supplementary and other Conditions of the Contract, including without limitation, the State of Rhode Island General Conditions of Purchase Regulation.

.9 Other documents listed below:

(Paragraph Deleted)

.1 The Solicitation, issued by the Owner, including without limitation, the Invitation to Bid, the Instructions to Bidders, the Specifications and Drawings, any Addenda, and the Bid Checklist.

(Paragraph Deleted)

.2 The Bid Proposal, including without limitation, the Bid Form and the Bidder Certification Cover Form.

(Table Deleted)

.3 The Purchase Order issued by the Owner.

§ 9.2 This Agreement and the Contract Documents are subject to, and governed by, the laws of the State of Rhode Island, including all procurement statutes and regulations (available at www.purchasing.ri.gov), and applicable federal and local law, all of which are fully incorporated into this Agreement by this reference.

(Table Deleted)

(Paragraph Deleted)

***§ 9.3** In the event of any conflict between or among the Contract Documents, or any Contract Documents and any provision of the State of Rhode Island Procurement Regulations and/or any other provision of the Rhode Island General Laws, the State of Rhode Island Procurement Regulations and the Rhode Island General Laws shall control.*

ARTICLE 10 BENEFITS OF AGREEMENT

§ 10.1 The User Agency is a disclosed third-party beneficiary of this Agreement and shall have all of the rights and benefits hereunder to which such a party is entitled. Nothing contained in this Agreement shall create a contractual relationship with, or a cause of action in favor of, any other third party against the Owner or the User Agency.

§ 10.2 This Agreement shall be binding on the Contractor and its successors and assigns; provided, however, that the Contractor may not assign its rights nor delegate its responsibilities under this Agreement without the Owner's prior written consent.

This Agreement is entered into as of the day and year first written above; provided, however, that this Agreement shall not become a valid, binding, and enforceable contract unless and until the Owner shall have issued a Purchase Order.

THE STATE OF RHODE ISLAND, acting by and through THE UNIVERSITY OF RHODE ISLAND PURCHASING DEPARMENT and RHODE ISLAND COUNCIL ON POSTSECONDARY EDUCATION

OWNER *(Signature)*

(Printed name and title)

CONTRACTOR *(Signature)*

(Printed name and title)

DOCUMENT 00 6140 - WAIVER OF LIEN FORM

U. R. I. Document Waiver of Lien Form is included, following this page, as an integral part of the Contract documents. A copy with completed information must be submitted with the second and each succeeding Application for Payment.

UNIVERSITY OF RHODE ISLAND

Construction Project Title: _____

General Contractor: _____

Subcontractor/Supplier: _____

DUNS No.: _____

Application and Certificate for Payment No: _____
(prior to Application accompanying this form)

Schedule of Values Line Item No.: _____

DESCRIPTION OF WORK Heading: _____

Total payment Received, Including Current Payment: $ _____

The undersigned Representative of the above Subcontractor/Supplier has been contracted by the above General Contractor to furnish materials, or labor, or both, as included in the approved Schedule of Values under the Line Item No.___, and DESCRIPTION OF WORK heading indicated above, for the Construction Project listed above.

The undersigned acknowledges receipt of payment, under this Line Item No., and DESCRIPTION OF WORK heading, and hereby waives and releases any and all lien, or claim or right to lien, on the Construction Project listed above, and premises, under the statutes of the State of Rhode Island, relating to Mechanics Liens, on account of materials, or labor, or both, furnished, or which may be furnished, by the undersigned to, or on account of, the above numbered Application and Certificate for Payment.

Signed on this _____ day of _____, 20__.

_____ _____
(signature) (firm name)

END OF DOCUMENT

DOCUMENT 00 7000 – GENERAL CONDITIONS

PART 1 – GENERAL

1.1 The General Conditions to be utilized on this project is AIA Document A201-2007 as amended, a copy of which follows this page.

END OF DOCUMENT

AIA® Document A201™ – 2007

General Conditions of the Contract for Construction

for the following PROJECT:
(Name and location or address)

THE OWNER:
(Name, legal status and address)
State of Rhode Island
One Capitol Hill, Second Floor
Providence, Rhode Island 02908-5855
(401) 574-8100 (telephone)
(401 574-8387 (facsimile)

(Paragraphs deleted)
acting by and though
(Paragraphs deleted)
The University of Rhode Island Purchasing Department
(Paragraphs deleted)
10 Tootell Road
Kingston, Rhode Island 02881
(401) 874-2171 (telephone)
(401) 874-2306 (facsmilie)
http://web.uri.edu/purchasing/

(Paragraph deleted)
and
Rhode Island Council on Postsecondary Education
560 Jefferson Boulevard, Suite 100
Warwick, Rhode Island, 02886
(401) 456-6000 (telephone)
(401) 732-3541 (facsimile)
On behalf of the User Agency

THE USER AGENCY

(Paragraphs deleted)
(Name, address, telephone and facsimile numbers, and web address)

The University of Rhode Island
(Paragraphs deleted)
Office of Capital Projects
(Paragraphs deleted)
60 Tootell Road – Sherman Building
Kingston, Rhode Island 02881
(Paragraphs deleted)
(401) 874-2725 (telephone)

(Paragraphs deleted)

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

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

Init.
/

THE Design Agent:
(Paragraphs deleted)
(Name, legal status, address, telephone and facsimile numbers, and web address)

TABLE OF ARTICLES

ARTICLE 1 GENERAL PROVISIONS

§ 1.1 BASIC DEFINITIONS

§ 1.1.1 THE CONTRACT DOCUMENTS

The Contract Documents are enumerated in the Agreement between the Owner and Contractor (the Agreement) and consist of the Agreement (and the documents enumerated therein), Conditions of the Contract (General Conditions, Supplementary Conditions, if any, and other Conditions), Drawings, Specifications, Addenda issued prior to execution of the Contract, other documents listed in the Agreement and Modifications issued after execution of the Contract. A Modification is (1) a written amendment to the Contract signed by both parties, (2) a Change Order, (3) a Construction Change Directive or (4) a written order for a minor change in the Work issued by the Design Agent.

§ 1.1.2 THE CONTRACT

The Contract Documents form the Contract for Construction. The Contract represents the entire and integrated agreement between the parties hereto and supersedes prior negotiations, representations or agreements, either written or oral. The Contract may be amended or modified only by a Modification. The Contract Documents shall not be construed to create a contractual relationship of any kind (1) between the Contractor and the Design Agent or the Design Agent's consultants, (2) between the Owner and a Subcontractor or a Sub-subcontractor, (3) between the Owner and the Design Agent or the Design Agent's consultants or (4) between any persons or entities other than the Owner and the Contractor. The Design Agent shall, however, be entitled to performance and enforcement of obligations under the Contract intended to facilitate performance of the Design Agent's duties.

§ 1.1.3 THE WORK

The term "Work" means the construction and services required by the Contract Documents, whether completed or partially completed, and includes all other labor, materials, equipment and services provided or to be provided by the Contractor to fulfill the Contractor's obligations. The Work may constitute the whole or a part of the Project.

§ 1.1.4 THE PROJECT

The Project is the total construction of which the Work performed under the Contract Documents may be the whole or a part and which may include construction by the Owner and by separate contractors.

§ 1.1.5 THE DRAWINGS

The Drawings are the graphic and pictorial portions of the Contract Documents showing the design, location, and dimensions of the Work, generally including plans, elevations, sections, details, schedules, and diagrams.

§ 1.1.6 THE SPECIFICATIONS

The Specifications are that portion of the Contract Documents consisting of the written requirements for materials, equipment, systems, standards and workmanship for the Work, and performance of related services.

§ 1.1.7 INSTRUMENTS OF SERVICE

Instruments of Service are representations, in any medium of expression now known or later developed, of the tangible and intangible creative work performed by the Design Agent and the Design Agent's consultants under their respective professional services agreements. Instruments of Service may include, without limitation, studies, surveys, models, sketches, drawings, specifications, and other similar materials.

§ 1.1.8 INITIAL DECISION MAKER

The Initial Decision Maker is the person identified in the Agreement to render initial decisions on Claims in accordance with Section 15.2 and certify termination of the Agreement under Section 14.2.2.

§ 1.2 CORRELATION AND INTENT OF THE CONTRACT DOCUMENTS

§ 1.2.1 The intent of the Contract Documents is to include all items and services necessary for the proper execution and completion of the Work by the Contractor. The Contract Documents are complementary, and what is required by one shall be as binding as if required by all; the Contractor shall perform all work reasonably inferable from the Contract Documents as being necessary to produce the indicated results.

§ 1.2.2 Organization of the Specifications into divisions, sections and articles, and arrangement of Drawings shall not control the Contractor in dividing the Work among Subcontractors or in establishing the extent of Work to be performed by any trade.

§ 1.2.3 Unless otherwise stated in the Contract Documents, words that have well-known technical or construction industry meanings are used in the Contract Documents in accordance with such recognized meanings.

§ 1.2.4 In the event of any conflicts or discrepancies among the Contract Documents, the provisions of the Contract Documents will be interpreted in the following order of priority:

.1 Modifications (if any).
.2 The Purchase Order.
.3 The Agreement.
.4 The Solicitation, including any Addenda, and the Specifications and Drawings
.5 The Supplementary Conditions (if any).
.6 The General Conditions.
.7 The Bid Proposal.

§ 1.2.5 In the event of any conflicts or discrepancies between the Contract Documents and the State of Rhode Island Procurement Regulations or any provision of the Rhode Island General Laws, the State of Rhode Island Procurement Regulations and the Rhode Island General Laws will control.

§ 1.2.6 In the event of any inconsistency between the Drawings and Specifications, the better quality or greater quantity of Work shall be provided.

§ 1.2.7 The Owner will be the final decision maker for any and all interpretations.

§ 1.3 CAPITALIZATION

Terms capitalized in these General Conditions include those that are (1) specifically defined, (2) the titles of numbered articles or (3) the titles of other documents published by the American Institute of Architects.

§ 1.4 INTERPRETATION

In the interest of brevity the Contract Documents frequently omit modifying words such as "all" and "any" and articles such as "the" and "an," but the fact that a modifier or an article is absent from one statement and appears in another is not intended to affect the interpretation of either statement.

§ 1.5 OWNERSHIP AND USE OF DRAWINGS, SPECIFICATIONS AND OTHER INSTRUMENTS OF SERVICE

§ 1.5.1 The Owner and the User Agency shall have a perpetual license to utilize the Drawings, Specifications, and other documents, including electronic or digital documents, prepared by the Design Agent and the Design Agent's consultants, for the execution of the Project and shall have and retain all rights to use them and reproduce them for the production and maintenance of the Work described therein. The Contractor, Subcontractors, Sub-subcontractors, and material or equipment suppliers shall not own or claim a copyright in the Instruments of Service. Submittal or distribution to meet official regulatory requirements or for other purposes in connection with this Project is not to be construed as publication in derogation of the Design Agent's or Design Agent's consultants' reserved rights.

§ 1.5.2 The Contractor, Subcontractors, Sub-subcontractors and material or equipment suppliers are authorized to use and reproduce the Instruments of Service provided to them solely and exclusively for execution of the Work. All copies made under this authorization shall bear the copyright notice, if any, shown on the Instruments of Service. The Contractor, Subcontractors, Sub-subcontractors, and material or equipment suppliers may not use the Instruments of Service on other projects or for additions to this Project outside the scope of the Work without the specific written consent of the Owner, Design Agent and the Design Agent's consultants.

§ 1.6 TRANSMISSION OF DATA IN DIGITAL FORM

If the parties intend to transmit Instruments of Service or any other information or documentation in digital form, they shall endeavor to establish necessary protocols governing such transmissions, unless otherwise already provided in the Agreement or the Contract Documents.

ARTICLE 2 OWNER

§ 2.1 GENERAL

§ 2.1.1 The Owner is the person or entity identified as such in the Agreement and is referred to throughout the Contract Documents as if singular in number. The Owner shall designate in writing a representative who shall have express

authority to bind the Owner with respect to all matters requiring the Owner's approval or authorization. Except as otherwise provided in Section 4.2.1, the Design Agent does not have such authority. The term "Owner" means the Owner or the Owner's authorized representative.

§ 2.1.2 Deleted.

§ 2.2 INFORMATION AND SERVICES REQUIRED OF THE OWNER

§ 2.2.1 Deleted.

§ 2.2.2 The Contractor shall secure and pay for permits and fees, necessary approvals, easements, assessments and charges required for construction, use or occupancy of permanent structures or for permanent changes in existing facilities.

§ 2.2.3 If required for the Work in the discretion of the Owner, the Owner shall furnish surveys describing physical characteristics, legal limitations and utility locations for the site of the Project, and a legal description of the site. The Contractor shall be entitled to rely on the accuracy of any information furnished by the Owner but shall exercise proper precautions relating to the safe performance of the Work.

§ 2.2.4 The Owner shall furnish information or services required of the Owner by the Contract Documents with reasonable promptness. The Owner shall also furnish any other information or services under the Owner's control and relevant to the Contractor's performance of the Work with reasonable promptness after receiving the Contractor's written request for such information or services.

§ 2.2.5 Deleted.

§ 2.3 OWNER'S RIGHT TO STOP THE WORK

If the Contractor fails to correct Work that is not in accordance with the requirements of the Contract Documents as required by Section 12.2 or repeatedly fails to carry out Work in accordance with the Contract Documents, the Owner may issue a written order to the Contractor to stop the Work, or any portion thereof, until the cause for such order has been eliminated; however, the right of the Owner to stop the Work shall not give rise to a duty on the part of the Owner to exercise this right for the benefit of the Contractor or any other person or entity, except to the extent required by Section 6.1.3.

§ 2.4 OWNER'S RIGHT TO CARRY OUT THE WORK

If the Contractor defaults or neglects to carry out the Work in accordance with the Contract Documents and fails within a 10 working-day period after receipt of written notice from the Owner to commence and continue correction of such default or neglect with diligence and promptness, the Owner may, without prejudice to other remedies the Owner may have, correct such deficiencies. In such case an appropriate Change Order shall be issued deducting from payments then or thereafter due the Contractor the reasonable cost of correcting such deficiencies, including Owner's expenses and compensation for the Design Agent's additional services made necessary by such default, neglect, or failure. Such action by the Owner and amounts charged to the Contractor are both subject to prior approval of the Design Agent. If payments then or thereafter due the Contractor are not sufficient to cover such amounts, the Contractor shall pay the difference to the Owner.

ARTICLE 3 CONTRACTOR

§ 3.1 GENERAL

§ 3.1.1 The Contractor is the person or entity identified as such in the Agreement and is referred to throughout the Contract Documents as if singular in number. The Contractor shall be lawfully licensed. The Contractor shall designate in writing a representative who shall have express authority to bind the Contractor with respect to all matters under this Contract. The term "Contractor" means the Contractor or the Contractor's authorized representative.

§ 3.1.2 The Contractor shall perform the Work in accordance with the Contract Documents.

§ 3.1.3 The Contractor shall not be relieved of obligations to perform the Work in accordance with the Contract Documents either by activities or duties of the Design Agent, or by tests, inspections, or approvals required or performed by persons or entities other than the Contractor.

§ 3.2 REVIEW OF CONTRACT DOCUMENTS AND FIELD CONDITIONS BY CONTRACTOR

§ 3.2.1 Execution of the Contract by the Contractor is a representation that the Contractor has visited the site, become generally familiar with local conditions under which the Work is to be performed and correlated personal observations with requirements of the Contract Documents.

§ 3.2.2 Because the Contract Documents are complementary, the Contractor shall, before starting each portion of the Work, carefully study and compare the various Contract Documents relative to that portion of the Work, as well as the information furnished by the Owner pursuant to Section 2.2.3, shall take field measurements of any existing conditions related to that portion of the Work, and shall observe any conditions at the site affecting it. These obligations are for the purpose of facilitating coordination and construction by the Contractor and are not for the purpose of discovering errors, omissions, or inconsistencies in the Contract Documents; however, the Contractor shall promptly report to the Owner and the Design Agent any errors, inconsistencies, or omissions discovered by or made known to the Contractor or additional Drawings, Specifications, or instructions required to define the Work in greater detail to permit the proper progress of the Work as a request for information in such form as the Design Agent may require. It is recognized that the Contractor's review is made in the Contractor's capacity as a contractor and not as a licensed design professional, unless otherwise specifically provided in the Contract Documents.

§ 3.2.3 The Contractor is not required to ascertain that the Contract Documents are in accordance with applicable laws, statutes, ordinances, codes, rules and regulations, or lawful orders of public authorities, but the Contractor shall promptly report to the Design Agent and the Owner any nonconformity discovered by or made known to the Contractor as a request for information in such form as the Design Agent or Owner may require.

§ 3.2.3.1 Omissions from the Drawings and Specifications of items obviously needed to perform the Work properly, such as attachments, bolts, hangers, and other fastening devices, shall not relieve the Contractor from the obligation to furnish and install such items.

§ 3.2.4 If the Contractor believes that additional cost or time is involved because of clarifications or instructions the Design Agent issues in response to the Contractor's notices or requests for information pursuant to Sections 3.2.2 or 3.2.3, the Contractor shall make Claims as provided in Article 15. If the Contractor fails to perform the obligations of Sections 3.2.2, 3.2.3, or 3.2.3.1, the Contractor shall pay such costs and damages to the Owner as would have been avoided if the Contractor had performed such obligations. If the Contractor performs those obligations, the Contractor shall not be liable to the Owner or Design Agent for damages resulting from errors, inconsistencies, or omissions in the Contract Documents, for differences between field measurements or conditions and the Contract Documents, or for nonconformities of the Contract Documents to applicable laws, statutes, ordinances, codes, rules and regulations, and lawful orders of public authorities.

§ 3.2.4.1 The Contractor shall not make any changes without prior written authorization from the Design Agent and the Owner.

§ 3.2.5 The Owner is entitled to reimbursement from the Contractor for amounts paid to the Design Agent for evaluating and responding to the Contractor's requests for information that are not prepared in accordance with the Contract Documents or where the requested information is available to the Contractor from a careful study and comparison of the Contract Documents, field conditions, other Owner-provided information, Contractor-prepared coordination drawings, or prior Project correspondence or documentation.

§ 3.3 SUPERVISION AND CONSTRUCTION PROCEDURES

§ 3.3.1 The Contractor shall supervise and direct the Work, using the Contractor's best skill and attention. The Contractor shall be solely responsible for, and have control over, construction means, methods, techniques, sequences and procedures and for coordinating all portions of the Work under the Contract, unless the Contract Documents give other specific instructions concerning these matters. If the Contract Documents give specific instructions concerning construction means, methods, techniques, sequences or procedures, the Contractor shall evaluate the jobsite safety thereof and, except as stated below, shall be fully and solely responsible for the jobsite safety of such means, methods, techniques, sequences or procedures. If the Contractor determines that such means, methods, techniques, sequences or procedures may not be safe, the Contractor shall give timely written notice to the Owner and Design Agent and shall not proceed with that portion of the Work without further written instructions from the Design Agent. If the Contractor is then instructed to proceed with the required means, methods, techniques, sequences or procedures without

acceptance of changes proposed by the Contractor, the Owner shall be solely responsible for any loss or damage arising solely from those Owner-required means, methods, techniques, sequences or procedures.

§ 3.3.2 The Contractor shall be responsible to the Owner for acts and omissions of the Contractor's employees, Subcontractors and their agents and employees, and other persons or entities performing portions of the Work for, or on behalf of, the Contractor or any of its Subcontractors.

§ 3.3.3 The Contractor shall be responsible for inspection of portions of Work already performed to determine that such portions are in proper condition to receive subsequent Work.

§ 3.4 LABOR AND MATERIALS

§ 3.4.1 Unless otherwise provided in the Contract Documents, the Contractor shall provide and pay for labor, materials, equipment, tools, construction equipment and machinery, water, heat, utilities, transportation, and other facilities and services necessary for proper execution and completion of the Work, whether temporary or permanent and whether or not incorporated or to be incorporated in the Work. Whenever the Contractor has an obligation to provide labor and materials under the Agreement, the Contractor, at a minimum, shall provide the labor for, and furnish and install and place in operation all items, including without limitation, all proper connections.

§ 3.4.2 Except in the case of minor changes in the Work authorized by the Design Agent in accordance with Sections 3.12.8 or 7.4, the Contractor may make substitutions only with the consent of the Owner, after evaluation by the Design Agent and in accordance with a Change Order or Construction Change Directive.

§ 3.4.3 The Contractor shall enforce strict discipline and good order among the Contractor's employees and other persons carrying out the Work. The Contractor shall not permit employment of unfit persons or persons not properly skilled in tasks assigned to them.

§ 3.5 WARRANTY

The Contractor warrants to the Owner and the Design Agent that materials and equipment furnished under the Contract will be of first quality, prime manufacture, and new unless the Contract Documents require or permit otherwise. The Contractor further warrants that the Work will conform to the requirements of the Contract Documents and will be free from defects, except for those inherent in the quality of the Work the Contract Documents require or permit. Work, materials, or equipment not conforming to these requirements, including substitutions not properly authorized, may be considered defective and, unless a longer period is required elsewhere in the Contract Documents, will be repaired and/or replaced, at the option of the Owner, for a period of one year following Final Completion of the Work. The Contractor's warranty excludes remedy for damage or defect caused by abuse, alterations to the Work not executed by the Contractor, improper or insufficient maintenance, improper operation, or normal wear and tear and normal usage. If required by the Design Agent, the Contractor shall furnish satisfactory evidence as to the kind and quality of materials and equipment.

§ 3.6 TAXES

§ 3.6.1 The Contractor shall pay sales, consumer, use and similar taxes for the Work provided by the Contractor that are legally enacted when bids are received or negotiations concluded, whether or not yet effective or merely scheduled to go into effect.

§ 3.6.2 The State of Rhode Island is exempt from payment of any federal or state excise, transportation, or sales tax. The Rhode Island Department of Administration Division of Purchases will furnish Exemption Certificates upon request.

§ 3.6.3 Pursuant to R.I. Gen. Laws § 44-1-6, the Owner shall withhold payment from the Contractor if the Contractor does not maintain a regular place of business in Rhode Island in the amount of three (3%) percent of the Contract Sum until 30 calendar days after Final Completion and compliance by the Contractor with the requirements of such section.

§ 3.7 PERMITS, FEES, NOTICES AND COMPLIANCE WITH LAWS

§ 3.7.1 Unless otherwise provided in the Contract Documents, the Contractor shall secure and pay for the building permit as well as for other permits, fees, licenses, and inspections required by the Rhode Island State Building Code

necessary for proper execution and completion of the Work that are customarily secured after execution of the Contract and legally required at the time bids are received or negotiations concluded. The Contractor shall be responsible for obtaining the Certificate of Occupancy from the appropriate governmental authorities.

§ 3.7.2 The Contractor shall comply with and give notices required by applicable laws, statutes, ordinances, codes, rules and regulations, and lawful orders of public authorities applicable to performance of the Work.

§ 3.7.3 The Contractor shall promptly notify the Design Agent and the Owner if the Contractor becomes aware that the Contract Documents are not in accordance with applicable laws, statutes, ordinances, codes, rules and regulations, or lawful orders of public authorities. If the Contractor performs Work knowing it to be contrary to applicable laws, statutes, ordinances, codes, rules and regulations, or lawful orders of public authorities, the Contractor shall assume appropriate responsibility for such Work and shall bear the costs attributable to correction.

§ 3.7.4 Concealed or Unknown Conditions. If the Contractor encounters conditions at the site that are (1) subsurface or otherwise concealed physical conditions that differ materially from those indicated in the Contract Documents or (2) unknown physical conditions of an unusual nature, that differ materially from those ordinarily found to exist and generally recognized as inherent in construction activities of the character provided for in the Contract Documents, the Contractor shall promptly provide notice to the Owner and the Design Agent before conditions are disturbed and in no event later than 21 working days after first observance of the conditions. The Design Agent will promptly investigate such conditions and, if the Design Agent determines that they differ materially and cause an increase or decrease in the Contractor's cost of, or time required for, performance of any part of the Work, will recommend an equitable adjustment in the Contract Sum or Contract Time, or both. If the Design Agent determines that the conditions at the site are not materially different from those indicated in the Contract Documents and that no change in the terms of the Contract is justified, the Design Agent shall promptly notify the Owner and Contractor in writing, stating the reasons. If either party disputes the Design Agent's determination or recommendation, that party may proceed as provided in Article 15.

§ 3.7.5 If, in the course of the Work, the Contractor encounters human remains or recognizes the existence of burial markers, archaeological sites or wetlands not indicated in the Contract Documents, the Contractor shall immediately suspend any operations that would affect them and shall notify the Owner and Design Agent. Upon receipt of such notice, the Owner shall promptly take any action necessary to obtain governmental authorization required to resume the operations. The Contractor shall continue to suspend such operations until otherwise instructed by the Owner but shall continue with all other operations that do not affect those remains or features. Requests for adjustments in the Contract Sum and Contract Time arising from the existence of such remains or features may be made as provided in Article 15.

§ 3.8 ALLOWANCES

§ 3.8.1 The Contractor shall include in the Contract Sum all allowances stated in the Contract Documents. Items covered by allowances shall be supplied for such amounts and by such persons or entities as the Owner may direct, but the Contractor shall not be required to employ persons or entities to whom the Contractor has reasonable objection.

§ 3.8.2 Unless otherwise provided in the Contract Documents,

- **.1** Allowances shall cover the cost to the Contractor of materials and equipment delivered at the site and all required taxes, less applicable trade discounts;
- **.2** Contractor's costs for unloading and handling at the site, labor, installation costs, overhead, profit and other expenses contemplated for stated allowance amounts shall be included in the Contract Sum but not in the allowances; and
- **.3** Whenever costs are more than or less than allowances, the Contract Sum shall be adjusted accordingly by Change Order. The amount of the Change Order shall reflect (1) the difference between actual costs and the allowances under Section 3.8.2.1 and (2) changes in Contractor's costs under Section 3.8.2.2.

§ 3.8.3 Materials and equipment under an allowance shall be selected by the Owner with reasonable promptness.

§ 3.9 SUPERINTENDENT

§ 3.9.1 The Contractor shall employ a competent superintendent and necessary assistants who shall be in attendance at the Project site during performance of the Work. The superintendent shall represent the Contractor, and communications given to the superintendent shall be as binding as if given to the Contractor.

§ 3.9.2 The Contractor, as soon as practicable after award of the Contract, shall furnish in writing to the Owner through the Design Agent the name and qualifications of a proposed superintendent. The Design Agent may reply within 14 working days to the Contractor in writing stating (1) whether the Owner or the Design Agent has reasonable objection to the proposed superintendent or (2) that the Design Agent requires additional time to review. Failure of the Design Agent to reply within the 14 working-day period shall constitute notice of no reasonable objection.

§ 3.9.3 The Contractor shall not employ a proposed superintendent to whom the Owner or Design Agent has made reasonable and timely objection. The Contractor shall not change the superintendent without the Owner's consent, which shall not unreasonably be withheld or delayed.

§ 3.10 CONTRACTOR'S CONSTRUCTION SCHEDULES

§ 3.10.1 The Contractor, within 20 working days after the issuance of the Purchase Order, shall prepare and submit for the Owner's and Design Agent's information a Contractor's construction schedule for the Work. The schedule shall not exceed time limits current under the Contract Documents, shall be revised at appropriate intervals, not less frequently than monthly, as required by the conditions of the Work and Project, shall be related to the entire Project to the extent required by the Contract Documents, and shall provide for expeditious and practicable execution of the Work. The Contractor shall certify on the initial schedule and all revised schedules that they comply with the Contract Documents.

§ 3.10.2 The Contractor shall prepare a submittal schedule, within 20 working days after the issuance of the Purchase Order, and thereafter as necessary to maintain a current submittal schedule, and shall submit the schedule(s) for the Owner's and the Design Agent's approval. The Owner's and the Design Agent's approval shall not unreasonably be delayed or withheld. The submittal schedule shall (1) be coordinated with the Contractor's construction schedule, and (2) allow the Owner and the Design Agent reasonable time to review submittals. If the Contractor fails to submit a submittal schedule, the Contractor shall not be entitled to any increase in Contract Sum or extension of Contract Time based on the time required for review of submittals.

§ 3.10.3 The Contractor shall perform the Work in general accordance with the most recent schedules submitted to the Owner and Design Agent.

§ 3.11 DOCUMENTS AND SAMPLES AT THE SITE

The Contractor shall maintain at the site for the Owner one copy of the Drawings, Specifications, Addenda, Change Orders and other Modifications, in good order and marked currently to indicate field changes and selections made during construction, and one copy of approved Shop Drawings, Product Data, Samples and similar required submittals. These shall be available to the Design Agent and shall be delivered to the Design Agent for submittal to the Owner upon completion of the Work as a record of the Work as constructed.

§ 3.12 SHOP DRAWINGS, PRODUCT DATA AND SAMPLES

§ 3.12.1 Shop Drawings are drawings, diagrams, schedules and other data specially prepared for the Work by the Contractor or a Subcontractor, Sub-subcontractor, manufacturer, supplier or distributor to illustrate some portion of the Work.

§ 3.12.2 Product Data are illustrations, standard schedules, performance charts, instructions, brochures, diagrams and other information furnished by the Contractor to illustrate materials or equipment for some portion of the Work.

§ 3.12.3 Samples are physical examples that illustrate materials, equipment or workmanship and establish standards by which the Work will be judged.

§ 3.12.4 Shop Drawings, Product Data, Samples and similar submittals are not Contract Documents. Their purpose is to demonstrate the way by which the Contractor proposes to conform to the information given and the design concept expressed in the Contract Documents for those portions of the Work for which the Contract Documents require submittals. Review by the Design Agent is subject to the limitations of Section 4.2.7. Informational submittals upon which the Design Agent is not expected to take responsive action may be so identified in the Contract Documents. Submittals that are not required by the Contract Documents may be returned by the Design Agent without action.

§ 3.12.5 The Contractor shall review for compliance with the Contract Documents, approve and submit to the Design Agent Shop Drawings, Product Data, Samples and similar submittals required by the Contract Documents in accordance with the submittal schedule approved by the Owner and the Design Agent or, in the absence of an approved submittal schedule, with reasonable promptness and in such sequence as to cause no delay in the Work or in the activities of the Owner or of separate contractors.

§ 3.12.6 By submitting Shop Drawings, Product Data, Samples and similar submittals, the Contractor represents to the Owner and Design Agent that the Contractor has (1) reviewed and approved them, (2) determined and verified materials, field measurements and field construction criteria related thereto, or will do so and (3) checked and coordinated the information contained within such submittals with the requirements of the Work and of the Contract Documents.

§ 3.12.7 The Contractor shall perform no portion of the Work for which the Contract Documents require submittal and review of Shop Drawings, Product Data, Samples or similar submittals until the respective submittal has been approved by the Design Agent.

§ 3.12.8 The Work shall be in accordance with approved submittals except that the Contractor shall not be relieved of responsibility for deviations from requirements of the Contract Documents by the Design Agent's approval of Shop Drawings, Product Data, Samples or similar submittals unless the Contractor has specifically informed the Design Agent in writing of such deviation at the time of submittal and (1) the Design Agent has given written approval to the specific deviation as a minor change in the Work, or (2) a Change Order or Construction Change Directive has been issued authorizing the deviation. The Contractor shall not be relieved of responsibility for errors or omissions in Shop Drawings, Product Data, Samples or similar submittals by the Design Agent's approval thereof.

§ 3.12.9 The Contractor shall direct specific attention, in writing or on resubmitted Shop Drawings, Product Data, Samples or similar submittals, to revisions other than those requested by the Design Agent on previous submittals. In the absence of such written notice, the Design Agent's approval of a resubmission shall not apply to such revisions.

§ 3.12.10 The Contractor shall not be required to provide professional services that constitute the practice of architecture or engineering unless such services are specifically required by the Contract Documents for a portion of the Work or unless the Contractor needs to provide such services in order to carry out the Contractor's responsibilities for construction means, methods, techniques, sequences and procedures. The Contractor shall not be required to provide professional services in violation of applicable law. If professional design services or certifications by a design professional related to systems, materials or equipment are specifically required of the Contractor by the Contract Documents, the Owner and the Design Agent will specify all performance and design criteria that such services must satisfy. The Contractor shall cause such services or certifications to be provided by a properly licensed design professional, whose signature and seal shall appear on all drawings, calculations, specifications, certifications, Shop Drawings and other submittals prepared by such professional. Shop Drawings and other submittals related to the Work designed or certified by such professional, if prepared by others, shall bear such professional's written approval when submitted to the Design Agent. The Owner and the Design Agent shall be entitled to rely upon the adequacy, accuracy and completeness of the services, certifications, and approvals performed or provided by such design professionals, provided the Owner and Design Agent have specified to the Contractor all performance and design criteria that such services must satisfy. Pursuant to this Section 3.12.10, the Design Agent will review, approve, or take other appropriate action on submittals only for the limited purpose of checking for conformance with information given and the design concept expressed in the Contract Documents. The Contractor shall not be responsible for the adequacy of the performance and design criteria specified in the Contract Documents.

§ 3.12.11 The Owner shall be entitled to reimbursement from the Contractor for amounts paid to the Design Agent for evaluation of resubmittals.

§ 3.13 USE OF SITE

The Contractor shall confine operations at the site to areas permitted by applicable laws, statutes, ordinances, codes, rules and regulations, and lawful orders of public authorities, and any restrictions imposed by the User Agency or the Owner, and the Contract Documents and shall not unreasonably encumber the site with materials or equipment.

§ 3.14 CUTTING AND PATCHING

§ 3.14.1 The Contractor shall be responsible for cutting, fitting or patching required to complete the Work or to make its parts fit together properly. All areas requiring cutting, fitting and patching shall be restored to the condition existing prior to the cutting, fitting and patching, unless otherwise required by the Contract Documents.

§ 3.14.2 The Contractor shall not damage or endanger a portion of the Work or fully or partially completed construction of the Owner or separate contractors by cutting, patching or otherwise altering such construction, or by excavation. The Contractor shall not cut or otherwise alter such construction by the Owner or a separate contractor except with written consent of the Owner and of such separate contractor; such consent shall not be unreasonably withheld. The Contractor shall not unreasonably withhold from the Owner or a separate contractor the Contractor's consent to cutting or otherwise altering the Work.

§ 3.15 CLEANING UP

§ 3.15.1 The Contractor shall keep the premises and surrounding area free from accumulation of waste materials or rubbish caused by operations under the Contract. At completion of the Work, the Contractor shall remove waste materials, rubbish, the Contractor's tools, construction equipment, machinery and surplus materials from and about the Project.

§ 3.15.2 If the Contractor fails to clean up as provided in the Contract Documents, the Owner may do so and Owner shall be entitled to reimbursement from the Contractor.

§ 3.16 ACCESS TO WORK

The Contractor shall provide the Owner and Design Agent access to the Work in preparation and progress wherever located.

§ 3.17 ROYALTIES, PATENTS AND COPYRIGHTS

The Contractor shall pay all royalties and license fees. The Contractor shall defend suits or claims for infringement of copyrights and patent rights and shall hold the Owner and Design Agent harmless from loss on account thereof, but shall not be responsible for such defense or loss when a particular design, process or product of a particular manufacturer or manufacturers is required by the Contract Documents, or where the copyright violations are contained in Drawings, Specifications or other documents prepared by the Owner or Design Agent. However, if the Contractor has reason to believe that the required design, process or product is an infringement of a copyright or a patent, the Contractor shall be responsible for such loss unless such information is promptly furnished to the Design Agent and the Owner.

§ 3.18 INDEMNIFICATION

§ 3.18.1 To the fullest extent permitted by law the Contractor shall indemnify and hold harmless the Owner, the State of Rhode Island, and each executive, legislative, judicial, regulatory, and administrative body of the state, and any political subdivision thereof, including without limitation, any department, division, agency, commission, board, office, bureau, committee, authority, educational institution, school, water, and fire district, and other agency of Rhode Island state, municipal, and local government that exercises governmental functions, any other governmental authority, and any quasi-public corporation and/or body corporate and politic, including without limitation, the User Agency, their elected and appointed officials, members, employees, and agents , the Design Agent, the Design Agent's Consultants, Subconsultants, and Subcontractors, and agents and employees and any of them from and against any and all claims, demands, damages, liabilities, judgments, losses and expenses, including but not limited to attorneys' fees and costs of mediation, arbitration, and/or litigation, arising out of or resulting from performance of the Work, and/or the obligations of the under the Contract Documents, but only to the extent caused by the acts or omissions of the Contractor, a Subcontractor, anyone directly or indirectly employed by them or anyone for whose acts they may be liable, regardless of whether or not any such claim, demand, damage, liability, judgment, loss or expense is caused in part by a party indemnified hereunder. Such obligation shall not be construed to negate, abridge, or reduce other rights or obligations of indemnity that would otherwise exist as to a party or person described in this Section 3.18.

§ 3.18.2 In claims against any person or entity indemnified under this Section 3.18 by an employee of the Contractor, a Subcontractor, anyone directly or indirectly employed by them or anyone for whose acts they may be liable, the indemnification obligation under Section 3.18.1 shall not be limited by a limitation on amount or type of damages,

compensation or benefits payable by or for the Contractor or a Subcontractor under workers' compensation acts, disability benefit acts or other employee benefit acts.

§ 3.18.3 Without limiting the generality of the foregoing, the defense and indemnity set forth in this Section 3.18 includes, without limitation, all liabilities, damages, losses, claims, demands, and actions on account of bodily injury, death, or property loss to a person or entity indemnified hereunder or any other persons or entities, whether based upon statutory (including, without limitation, workers compensation), contractual, tort, or other liability of any person or entity so indemnified.

§ 3.18.4 The remedies set forth herein shall not deprive any person indemnified hereunder of any other indemnity action, right, or remedy otherwise available to any such person or entity at common law or otherwise.

§ 3.18.5 The Contractor will include the indemnity set forth in this Section 3.18, without modification, in each Subcontract with any Subcontractor.

§ 3.18.6 Notwithstanding any other language in the Contract Documents to the contrary, the indemnity hereunder shall survive Final Completion of the Work and final payment under the Agreement and shall survive any termination of the Agreement.

ARTICLE 4 DESIGN AGENT

§ 4.1 GENERAL

§ 4.1.1 The Design Agent is the person lawfully licensed to practice his or her profession in the State of Rhode Island or an entity lawfully practicing its profession in the State of Rhode Island and identified in the Contract Documents as the Design Agent. The term "Design Agent" means the Design Agent or the Design Agent's authorized representative.

§ 4.1.2 Duties, responsibilities and limitations of authority of the Design Agent as set forth in the Contract Documents shall not be restricted, modified or extended without written consent of the Owner, Contractor and Design Agent. Consent shall not be unreasonably withheld.

§ 4.1.3 If the employment of the Design Agent is terminated, the Owner shall employ a successor Design Agent as to whom the Contractor has no reasonable objection and whose status under the Contract Documents shall be that of the Design Agent.

§ 4.2 ADMINISTRATION OF THE CONTRACT

§ 4.2.1 The Owner with assistance from the Design Agent will provide administration of the Contract as described in the Contract Documents and will be an Owner's representative during construction through the date the Design Agent issues the final Certificate for Payment and continuing until the expiration of the warranty period in Section 3.5. The Design Agent will have authority to act on behalf of the Owner only to the extent provided in the Contract Documents.

§ 4.2.2 The Design Agent will visit the site at intervals appropriate to the stage of construction, or as otherwise agreed with the Owner, to become generally familiar with the progress and quality of the portion of the Work completed, and to determine in general if the Work observed is being performed in a manner indicating that the Work, when fully completed, will be in accordance with the Contract Documents. However, the Design Agent will not be required to make exhaustive or continuous on-site inspections to check the quality or quantity of the Work. The Design Agent will not have control over, charge of, or responsibility for, the construction means, methods, techniques, sequences or procedures, or for the safety precautions and programs in connection with the Work, since these are solely the Contractor's rights and responsibilities under the Contract Documents, except as provided in Section 3.3.1.

§ 4.2.2.1 The Owner is entitled to reimbursement from the Contractor for amounts paid to the Design Agent for site visits made necessary by the fault of the Contractor or by defects and deficiencies in the Work.

§ 4.2.3 On the basis of the site visits, the Design Agent will keep the Owner reasonably informed about the progress and quality of the portion of the Work completed, and report to the Owner (1) known deviations from the Contract Documents and from the most recent construction schedule submitted by the Contractor, and (2) defects and deficiencies observed in the Work. The Design Agent will not be responsible for the Contractor's failure to perform the Work in accordance with the requirements of the Contract Documents. The Design Agent will not have control

over or charge of and will not be responsible for acts or omissions of the Contractor, Subcontractors, or their agents or employees, or any other persons or entities performing portions of the Work.

§ 4.2.4 COMMUNICATIONS FACILITATING CONTRACT ADMINISTRATION

Except as otherwise provided in the Contract Documents or when direct communications have been specially authorized, the Owner and Contractor shall endeavor to communicate with each other through the Design Agent about matters arising out of or relating to the Contract. Communications by and with the Design Agent's consultants shall be through the Design Agent. Communications by and with Subcontractors and material suppliers shall be through the Contractor. Communications by and with separate contractors shall be through the Owner.

§ 4.2.5 Based on the Design Agent's evaluations of the Contractor's Applications for Payment, the Design Agent will review and certify the amounts due the Contractor and will issue Certificates for Payment in such amounts.

§ 4.2.6 The Design Agent has authority to reject Work that does not conform to the Contract Documents. Whenever the Design Agent considers it necessary or advisable, the Design Agent will have authority to require inspection or testing of the Work in accordance with Sections 13.5.2 and 13.5.3, whether or not such Work is fabricated, installed or completed. However, neither this authority of the Design Agent nor a decision made in good faith either to exercise or not to exercise such authority shall give rise to a duty or responsibility of the Design Agent to the Contractor, Subcontractors, material and equipment suppliers, their agents or employees, or other persons or entities performing portions of the Work.

§ 4.2.7 The Design Agent will review and approve, or take other appropriate action upon, the Contractor's submittals such as Shop Drawings, Product Data and Samples, but only for the limited purpose of checking for conformance with information given and the design concept expressed in the Contract Documents. The Design Agent's action will be taken in accordance with the submittal schedule approved by the Design Agent or, in the absence of an approved submittal schedule, with reasonable promptness while allowing sufficient time in the Design Agent's professional judgment to permit adequate review. Review of such submittals is not conducted for the purpose of determining the accuracy and completeness of other details such as dimensions and quantities, or for substantiating instructions for installation or performance of equipment or systems, all of which remain the responsibility of the Contractor as required by the Contract Documents. The Design Agent's review of the Contractor's submittals shall not relieve the Contractor of the obligations under Sections 3.3, 3.5 and 3.12. The Design Agent's review shall not constitute approval of safety precautions or, unless otherwise specifically stated by the Design Agent, of any construction means, methods, techniques, sequences or procedures. The Design Agent's approval of a specific item shall not indicate approval of an assembly of which the item is a component.

§ 4.2.8 The Design Agent will prepare Change Orders and Construction Change Directives, and may authorize minor changes in the Work as provided in Section 7.4. The Design Agent will investigate and make determinations and recommendations regarding concealed and unknown conditions as provided in Section 3.7.4.

§ 4.2.9 The Design Agent will conduct inspections to determine the date or dates of Substantial Completion and the date of final completion; issue Certificates of Substantial Completion pursuant to Section 9.8; receive and forward to the Owner, for the Owner's review and records, written warranties and related documents required by the Contract and assembled by the Contractor pursuant to Section 9.10; and issue a final Certificate for Payment pursuant to Section 9.10.

§ 4.2.10 If the Owner and Design Agent agree, the Design Agent will provide one or more project representatives to assist in carrying out the Design Agent's responsibilities at the site. The duties, responsibilities and limitations of authority of such project representatives shall be as set forth in an exhibit to be incorporated in the Contract Documents.

§ 4.2.11 The Design Agent will interpret and decide matters concerning performance under, and requirements of, the Contract Documents on written request of either the Owner or Contractor. The Design Agent's response to such requests will be made in writing within any time limits agreed upon or otherwise with reasonable promptness.

§ 4.2.12 Interpretations and decisions of the Design Agent will be consistent with the intent of, and reasonably inferable from, the Contract Documents and will be in writing or in the form of drawings. When making such interpretations and decisions, the Design Agent will endeavor to secure faithful performance by both Owner and

Contractor, will not show partiality to either and will not be liable for results of interpretations or decisions rendered in good faith.

§ 4.2.13 The Design Agent's decisions on matters relating to aesthetic effect will be final if consistent with the intent expressed in the Contract Documents and approved by the Owner.

§ 4.2.14 The Design Agent will review and respond to requests for information about the Contract Documents. The Design Agent's response to such requests will be made in writing within any time limits agreed upon or otherwise with reasonable promptness. If appropriate, the Design Agent will prepare and issue supplemental Drawings and Specifications in response to the requests for information.

ARTICLE 5 SUBCONTRACTORS

§ 5.1 DEFINITIONS

§ 5.1.1 A Subcontractor is a person or entity who has a direct contract with the Contractor to perform a portion of the Work at the site. The term "Subcontractor" is referred to throughout the Contract Documents as if singular in number and means a Subcontractor or an authorized representative of the Subcontractor. The term "Subcontractor" does not include a separate contractor or subcontractors of a separate contractor.

§ 5.1.2 A Sub-subcontractor is a person or entity who has a direct or indirect contract with a Subcontractor to perform a portion of the Work at the site. The term "Sub-subcontractor" is referred to throughout the Contract Documents as if singular in number and means a Sub-subcontractor or an authorized representative of the Sub-subcontractor.

§ 5.2 AWARD OF SUBCONTRACTS AND OTHER CONTRACTS FOR PORTIONS OF THE WORK

§ 5.2.1 Unless otherwise stated in the Contract Documents or the bidding requirements, the Contractor, as soon as practicable after award of the Contract, shall furnish in writing to the Owner and the Design Agent the names of persons or entities (including those who are to furnish materials or equipment fabricated to a special design) proposed for each principal portion of the Work. The Owner may reply within 14 working days to the Contractor in writing stating (1) whether the Owner or the Design Agent has reasonable objection to any such proposed person or entity or (2) that the Owner or Design Agent requires additional time for review.

§ 5.2.2 The Contractor shall not contract with a proposed person or entity to whom the Owner or Design Agent has made reasonable and timely objection. The Contractor shall not be required to contract with anyone to whom the Contractor has made reasonable objection.

§ 5.2.3 If the Owner or Design Agent has reasonable objection to a person or entity proposed by the Contractor, the Contractor shall propose another to whom the Owner or Design Agent has no reasonable objection. If the proposed but rejected Subcontractor was reasonably capable of performing the Work, the Contract Sum and Contract Time shall be increased or decreased by the difference, if any, occasioned by such change, and an appropriate Change Order shall be issued before commencement of the substitute Subcontractor's Work. However, no increase in the Contract Sum or Contract Time shall be allowed for such change unless the Contractor has acted promptly and responsively in submitting names as required.

§ 5.2.4 The Contractor shall not substitute a Subcontractor, person or entity previously selected if the Owner or Design Agent makes reasonable objection to such substitution.

§ 5.2.5 MANUFACTURERS AND FABRICATORS

§ 5.2.5.1 Not later than 10 working days after the date of commencement of the Work, the Contractor shall furnish in writing to the Owner and the Design Agent the names of the manufacturers or fabricators for certain products, equipment, and systems identified in the Specifications and, where applicable, the name of the installing Subcontractor. The Owner may reply within 14 working days to the Contractor in writing, stating: (i) whether the Owner or the Design Agent has reasonable objection to any such proposed person manufacturer or fabricator; or (ii) whether the Owner or Design Agent requires additional time to review.

§ 5.2.5.2 The Contractor shall not contract with a proposed manufacturer, fabricator, or Subcontractor to whom the Owner or Design Agent has made reasonable and timely objection. The Contractor shall not be required to contract with anyone to whom the Contractor has made reasonable objection.

§ 5.2.5.3 If the Owner or Design Agent has an objection to a manufacturer, fabricator, or Subcontractor proposed by the Contractor, the Contractor shall propose another to whom the Owner or Design Agent has no objection.

§ 5.2.5.4 The Contractor shall not substitute a manufacturer, fabricator, or Subcontractor previously selected if the Owner or Design Agent makes reasonable objection to such substitution.

§ 5.3 SUBCONTRACTUAL RELATIONS

By appropriate written agreement, the Contractor shall require each Subcontractor, to the extent of the Work to be performed by the Subcontractor, to be bound to the Contractor by terms of the Contract Documents, and to assume toward the Contractor all the obligations and responsibilities, including the responsibility for safety of the Subcontractor's Work, which the Contractor, by these Documents, assumes toward the Owner and Design Agent. Upon the request of the User Agency and/or the Owner, the Contractor shall provide the User Agency and/or the Owner with copies of each subcontract agreement. Each subcontract agreement shall preserve and protect the rights of the Owner and Design Agent under the Contract Documents with respect to the Work to be performed by the Subcontractor so that subcontracting thereof will not prejudice such rights, and shall allow to the Subcontractor, unless specifically provided otherwise in the subcontract agreement, the benefit of all rights, remedies and redress against the Contractor that the Contractor, by the Contract Documents, has against the Owner. Where appropriate, the Contractor shall require each Subcontractor to enter into similar agreements with Sub-subcontractors. The Contractor shall make available to each proposed Subcontractor, prior to the execution of the subcontract agreement, copies of the Contract Documents to which the Subcontractor will be bound, and, upon written request of the Subcontractor, identify to the Subcontractor terms and conditions of the proposed subcontract agreement that may be at variance with the Contract Documents. Subcontractors will similarly make copies of applicable portions of such documents available to their respective proposed Sub-subcontractors.

§ 5.4 CONTINGENT ASSIGNMENT OF SUBCONTRACTS

§ 5.4.1 Each subcontract agreement for a portion of the Work is assigned by the Contractor to the Owner, provided that

.1 assignment is effective only after termination of the Contract by the Owner for cause pursuant to Section 14.2 and only for those subcontract agreements that the Owner accepts by notifying the Subcontractor and Contractor in writing; and

.2 assignment is subject to the prior rights of the surety, if any, obligated under bond relating to the Contract.

(Paragraph deleted)

§ 5.4.2 Upon such assignment, if the Work has been suspended for more than 30 working days, the Subcontractor's compensation shall be equitably adjusted for increases in cost resulting from the suspension.

§ 5.4.3 Upon such assignment to the Owner under this Section 5.4, the Owner may further assign the subcontract to a successor contractor or other entity.

ARTICLE 6 CONSTRUCTION BY OWNER OR BY SEPARATE CONTRACTORS

§ 6.1 OWNER'S RIGHT TO PERFORM CONSTRUCTION AND TO AWARD SEPARATE CONTRACTS

§ 6.1.1 The Owner reserves the right to perform construction or operations related to the Project with the Owner's own forces, and to award separate contracts in connection with other portions of the Project or other construction or operations on the site under Conditions of the Contract identical or substantially similar to these including those portions related to insurance and waiver of subrogation.

§ 6.1.2 When separate contracts are awarded for different portions of the Project or other construction or operations on the site, the term "Contractor" in the Contract Documents in each case shall mean the Contractor who executes each separate Owner-Contractor Agreement.

§ 6.1.3 The Owner shall provide for coordination of the activities of the Owner's own forces and of each separate contractor with the Work of the Contractor, who shall cooperate with them. The Contractor shall participate with other separate contractors and the Owner in reviewing their construction schedules. The Contractor shall make any revisions to the construction schedule deemed necessary after a joint review and mutual agreement. The construction schedules shall then constitute the schedules to be used by the Contractor, separate contractors and the Owner until subsequently revised.

§ 6.1.4 Unless otherwise provided in the Contract Documents, when the Owner performs construction or operations related to the Project with the Owner's own forces, the Owner shall be deemed to be subject to the same obligations and to have the same rights that apply to the Contractor under the Conditions of the Contract, including, without excluding others, those stated in Article 3, this Article 6 and Articles 10, 11 and 12.

§ 6.2 MUTUAL RESPONSIBILITY

§ 6.2.1 The Contractor shall afford the Owner and separate contractors reasonable opportunity for introduction and storage of their materials and equipment and performance of their activities, and shall connect and coordinate the Contractor's construction and operations with theirs as required by the Contract Documents.

§ 6.2.2 If part of the Contractor's Work depends for proper execution or results upon construction or operations by the Owner or a separate contractor, the Contractor shall, prior to proceeding with that portion of the Work, promptly report to the Design Agent apparent discrepancies or defects in such other construction that would render it unsuitable for such proper execution and results. Failure of the Contractor so to report shall constitute an acknowledgment that the Owner's or separate contractor's completed or partially completed construction is fit and proper to receive the Contractor's Work, except as to defects not then reasonably discoverable.

§ 6.2.3 The Contractor shall reimburse the Owner for costs the Owner incurs that are payable to a separate contractor because of the Contractor's delays, improperly timed activities or defective construction. The Owner shall be responsible to the Contractor for costs the Contractor incurs because of a separate contractor's delays, improperly timed activities, damage to the Work or defective construction.

§ 6.2.4 The Contractor shall promptly remedy damage the Contractor wrongfully causes to completed or partially completed construction or to property of the Owner or separate contractors as provided in Section 10.2.5.

§ 6.2.5 The Owner and each separate contractor shall have the same responsibilities for cutting and patching as are described for the Contractor in Section 3.14.

§ 6.3 OWNER'S RIGHT TO CLEAN UP

If a dispute arises among the Contractor, separate contractors and the Owner as to the responsibility under their respective contracts for maintaining the premises and surrounding area free from waste materials and rubbish, the Owner may clean up and allocate the cost among those responsible.

ARTICLE 7 CHANGES IN THE WORK

§ 7.1 GENERAL

§ 7.1.1 Changes in the Work may be accomplished after execution of the Contract, and without invalidating the Contract, by Change Order, Construction Change Directive or order for a minor change in the Work, subject to the limitations stated in this Article 7 and elsewhere in the Contract Documents.

§ 7.1.2 A Change Order shall be based upon agreement between the Owner and the Contractor; a Construction Change Directive requires agreement by the Owner and may or may not be agreed to by the Contractor; an order for a minor change in the Work may be issued by the Design Agent alone.

§ 7.1.3 Changes in the Work shall be performed under applicable provisions of the Contract Documents, and the Contractor shall proceed promptly, unless otherwise provided in the Change Order, Construction Change Directive or order for a minor change in the Work.

§ 7.2 CHANGE ORDERS

§ 7.2.1 A Change Order is a written instrument prepared by the Contractor and signed by the Owner, Contractor and Design Agent stating their agreement upon all of the following:

- **.1** The change in the Work;
- **.2** The amount of the adjustment, if any, in the Contract Sum; and
- **.3** The extent of the adjustment, if any, in the Contract Time.

§ 7.2.2 Subsequent to the approval of a Change Order as provided in § 7.1.2, whether such Change Order changes the Contract Sum or Contract Time or both, no additional claim related to such Change Order will be considered by the

Owner. Any change, once incorporated into a Change Order, is all inclusive, and includes all factors that could have been considered at the time of the Change Order such as Project impact or schedule "ripple" effect.

§ 7.3 CONSTRUCTION CHANGE DIRECTIVES

§ 7.3.1 A Construction Change Directive is a written order prepared by the Design Agent and signed by the Owner, directing a change in the Work prior to agreement on adjustment, if any, in the Contract Sum or Contract Time, or both. The Owner may by Construction Change Directive, without invalidating the Contract, order changes in the Work within the general scope of the Contract consisting of additions, deletions or other revisions, the Contract Sum and Contract Time being adjusted accordingly.

§ 7.3.2 A Construction Change Directive shall be used in the absence of total agreement on the terms of a Change Order.

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§ 7.3.3 If the Construction Change Directive provides for an adjustment to the Contract Sum, the adjustment shall be based on one of the following methods:

.1 Mutual acceptance of a lump sum properly itemized and supported by sufficient substantiating data to permit evaluation;

.2 Unit prices stated in the Contract Documents or subsequently agreed upon;

.3 Cost to be determined in a manner agreed upon by the parties and a mutually acceptable fixed or percentage fee; or

.4 As provided in Section 7.3.7.

§ 7.3.4 Deleted.

§ 7.3.5 Upon receipt of a Construction Change Directive, the Contractor shall promptly proceed with the change in the Work involved and advise the Design Agent of the Contractor's agreement or disagreement with the method, if any, provided in the Construction Change Directive for determining the proposed adjustment in the Contract Sum or Contract Time.

§ 7.3.6 A Construction Change Directive signed by the Contractor indicates the Contractor's agreement therewith, including adjustment in Contract Sum and Contract Time or the method for determining them. Such agreement shall be effective immediately and shall be recorded as a Change Order.

§ 7.3.7 If the Contractor does not respond promptly or disagrees with the method for adjustment in the Contract Sum, the Design Agent shall determine the method and the adjustment on the basis of reasonable expenditures and savings of those performing the Work attributable to the change, including, in case of an increase in the Contract Sum, an amount for overhead and profit as set forth in Section 7.3.1. In such case, and also under Section 7.3.3.3, the Contractor shall keep and present, in such form as the Design Agent may prescribe, an itemized accounting together with appropriate supporting data. Unless otherwise provided in the Contract Documents, costs for the purposes of this Section 7.3.7 shall be limited to the following:

.1 Costs of labor, including social security, old age and unemployment insurance, fringe benefits required by agreement or custom, and workers' compensation insurance;

.2 Costs of materials, supplies and equipment, including cost of delivery;

.3 Rental costs of machinery and equipment, exclusive of hand tools; or

.4 Costs of premiums for all bonds and insurance and permit fees related to the Work..

§ 7.3.8 The amount of credit to be allowed by the Contractor to the Owner for a deletion or change that results in a net decrease in the Contract Sum shall be actual net cost as confirmed by the Design Agent. When both additions and credits covering related Work or substitutions are involved in a change, the allowance for overhead and profit shall be figured on the basis of net increase, if any, with respect to that change.

§ 7.3.9 Pending final determination of the total cost of a Construction Change Directive to the Owner, the Contractor may request payment for Work completed under the Construction Change Directive in Applications for Payment. The Design Agent will make an interim determination for purposes of monthly certification for payment for those costs and certify for payment the amount that the Design Agent determines, in the Design Agent's professional judgment, to be reasonably justified. The Design Agent's interim determination of cost shall adjust the Contract Sum on the same

basis as a Change Order, subject to the right of either party to disagree and assert a Claim in accordance with Article 15.

§ 7.3.10 When the Owner and Contractor agree with a determination made by the Design Agent concerning the adjustments in the Contract Sum and Contract Time, or otherwise reach agreement upon the adjustments, such agreement shall be effective immediately and the Contractor will prepare a Change Order. Change Orders may be issued for all or any part of a Construction Change Directive.

§ 7.3.11 The combined overhead and profit included in the total cost to the Owner for a change in the Work shall be based on the following schedule:

.1 For the Contractor, for work performed by the Contractor's own forces, an amount not to exceed ten (10%) percent of the cost.

.2 For the Contractor, for work performed by the Contractor's Subcontractors, an amount not to exceed five (5%) of the amount due to the Subcontractors.

.3 For each Subcontractor, for work performed by the Subcontractor's own forces, an amount not to exceed ten (10%) percent of the cost.

.4 Where the Work represents both additions and deletions and results in a net increase, the allowable overhead and profit shall be in accordance with this Section 7.3.11, but in no event shall the amount exceed fifteen (15%) percent of the net increase in the cost of the Work.

§ 7.3.12 All proposals with an aggregate cost equal to or in excess of $500.00 shall be accompanied by a detailed itemization of costs, including labor, materials (quantities and prices), and Subcontracts, in a form acceptable to the Owner. In no event will a change order request reflecting an aggregate cost equal to or in excess of $500.00 be approved without such itemization.

§ 7.4 MINOR CHANGES IN THE WORK

The Design Agent with the prior written approval of the Owner has authority to order minor changes in the Work not involving adjustment in the Contract Sum or extension of the Contract Time and not inconsistent with the intent of the Contract Documents. Such changes will be affected by written order signed by the Design Agent and shall be binding on the Owner and Contractor.

ARTICLE 8 TIME

§ 8.1 DEFINITIONS

§ 8.1.1 Unless otherwise provided, Contract Time is the period of time, including authorized adjustments, allotted in the Contract Documents for Substantial Completion of the Work.

The date of commencement of the Work is the date established in Section 3.1 of the Agreement..

(Paragraph deleted)

§ 8.1.3 The date of Substantial Completion is the date certified by the Design Agent in accordance with Section 9.8.

§ 8.1.4 Deleted.

§ 8.2 PROGRESS AND COMPLETION

§ 8.2.1 Time limits stated in the Contract Documents are of the essence of the Contract. By executing the Agreement the Contractor confirms that the Contract Time is a reasonable period for performing the Work.

§ 8.2.2 The Contractor shall not except by agreement or instruction of the Owner in writing, prematurely commence operations on the site or elsewhere prior to the effective date of insurance required by Article 11 to be furnished by the Contractor and Owner. The date of commencement of the Work shall not be changed by the effective date of such insurance.

§ 8.2.3 The Contractor shall proceed expeditiously with adequate forces and shall achieve Substantial Completion within the Contract Time.

§ 8.3 DELAYS AND EXTENSIONS OF TIME

§ 8.3.1 If the Contractor is delayed at any time in the commencement or progress of the Work by an act or neglect of the Owner or Design Agent, or of an employee of either, or of a separate contractor employed by the Owner; or by changes ordered in the Work; or by labor disputes, fire, unusual delay in deliveries, unavoidable casualties or other causes beyond the Contractor's control, then the Contract Time shall be extended by Change Order for such reasonable time as the Owner may determine.

§ 8.3.2 Claims relating to time shall be made in accordance with applicable provisions of Article 15.

§ 8.3.3 This Section 8.3 does not preclude recovery of damages for delay by either party under other provisions of the Contract Documents.

ARTICLE 9 PAYMENTS AND COMPLETION

§ 9.1 CONTRACT SUM

The Contract Sum is stated in the Agreement and, including authorized adjustments, is the total amount payable by the Owner to the Contractor for performance of the Work under the Contract Documents.

§ 9.2 SCHEDULE OF VALUES

Within 20 working days of the issuance of the Purchase Order, and promptly if revision is necessary from time to time as a result of a Change Order, the Contractor shall submit to the Owner, before the first Application for Payment, a schedule of values allocating the entire Contract Sum to the various portions of the Work and prepared in such form and supported by such data to substantiate its accuracy as the Design Agent and the Owner may require. This schedule, if and when approved by the Design Agent and the Owner in writing, shall be used as a basis for reviewing the Contractor's Applications for Payment.

§ 9.3 APPLICATIONS FOR PAYMENT

§ 9.3.1 At least 10 working days before the date established for each progress payment, the Contractor shall submit to the Design Agent and the Owner for approval an itemized Application for Payment prepared in accordance with the schedule of values for completed portions of the Work. Such application shall be notarized, if required, and supported by such data substantiating the Contractor's right to payment as the Owner or the Design Agent may require, such as copies of requisitions from Subcontractors and material suppliers, and shall reflect retainage if provided for in the Contract Documents.

§ 9.3.1.1 All Applications for Payment for Change Orders must be accompanied by a Notice of Change in Purchase Order issued by the Owner, and if directed by the Owner, by the User Agency.

§ 9.3.1.2 Applications for Payment shall not include requests for payment for portions of the Work for which the Contractor does not intend to pay a Subcontractor or material supplier, unless such Work has been performed by others whom the Contractor intends to pay.

§ 9.3.1.3 The form of Application for Payment shall be AIA Document G702, Application and Certification for Payment, supported by AIA Document G702A, Continuation Sheet.

§ 9.3.1.4 Until final payment, the Owner shall pay ninety-five (95%) percent of the amount due the Contract on account of progress payments.

§ 9.3.2 Unless otherwise provided in the Contract Documents, payments shall be made on account of materials and equipment delivered and suitably stored at the site for subsequent incorporation in the Work. If approved in advance by the Owner, payment may similarly be made for materials and equipment suitably stored off the site at a location agreed upon in writing. Payment for materials and equipment stored on or off the site shall be conditioned upon compliance by the Contractor with procedures satisfactory to the Owner to establish the Owner's title to such materials and equipment or otherwise protect the Owner's interest, and shall include the costs of applicable insurance, storage and transportation to the site for such materials and equipment stored off the site.

§ 9.3.3 The Contractor warrants that title to all Work covered by an Application for Payment will pass to the Owner no later than the time of payment. The Contractor further warrants that upon submittal of an Application for Payment all Work for which Certificates for Payment have been previously issued and payments received from the Owner shall be

free and clear of liens, claims, security interests or encumbrances in favor of the Contractor, Subcontractors, material suppliers, or other persons or entities making a claim by reason of having provided labor, materials and equipment relating to the Work. The Contractor shall immediately satisfy any lien, claim, or encumbrance against the site where the Project is located and indemnify the Owner from and against all resulting costs and expenses, including without limitation, attorneys' fees.

§ 9.4 CERTIFICATES FOR PAYMENT

§ 9.4.1 The Design Agent will, within 7 working days after receipt of the Contractor's Application for Payment, either issue to the Owner a Certificate for Payment, with a copy to the Contractor, for such amount as the Design Agent determines is properly due, or notify the Contractor and Owner in writing of the Design Agent's reasons for withholding certification in whole or in part as provided in Section 9.5.1.

§ 9.4.2 The issuance of a Certificate for Payment will constitute a representation by the Design Agent to the Owner, based on the Design Agent's evaluation of the Work and the data comprising the Application for Payment, that, the Work has progressed to the point indicated and that the quality of the Work is in accordance with the Contract Documents. The foregoing representations are subject to an evaluation of the Work for conformance with the Contract Documents upon Substantial Completion, to results of subsequent tests and inspections, to correction of minor deviations from the Contract Documents prior to completion and to specific qualifications expressed by the Design Agent. The issuance of a Certificate for Payment will further constitute a representation that the Contractor is entitled to payment in the amount certified. However, the issuance of a Certificate for Payment will not be a representation that the Design Agent has (1) made exhaustive or continuous on-site inspections to check the quality or quantity of the Work, (2) reviewed construction means, methods, techniques, sequences or procedures, (3) reviewed copies of requisitions received from Subcontractors and material suppliers and other data requested by the Owner to substantiate the Contractor's right to payment, or (4) made examination to ascertain how or for what purpose the Contractor has used money previously paid on account of the Contract Sum.

§ 9.4.3 The Contractor must submit all product literature, material and color samples with each Application for Payment, or as otherwise required by the Owner.

§ 9.5 DECISIONS TO WITHHOLD CERTIFICATION

§ 9.5.1 The Design Agent will withhold a Certificate for Payment in whole or in part, to the extent reasonably necessary to protect the Owner, if in the Design Agent's opinion the representations to the Owner required by Section 9.4.2 cannot be made. If the Design Agent is unable to certify payment in the amount of the Application, the Design Agent will notify the Contractor and Owner as provided in Section 9.4.1. If the Contractor and Design Agent cannot agree on a revised amount, the Design Agent will promptly issue a Certificate for Payment for the amount for which the Design Agent is able to make such representations to the Owner. The Design Agent may also withhold a Certificate for Payment or, because of subsequently discovered evidence, may nullify the whole or a part of a Certificate for Payment previously issued, to such extent as may be necessary in the Design Agent's opinion to protect the Owner from loss for which the Contractor is responsible, including loss resulting from acts and omissions described in Section 3.3.2, because of:

- **.1** defective Work not remedied;
- **.2** third party claims filed or reasonable evidence indicating probable filing of such claims unless security acceptable to the Owner is provided by the Contractor;
- **.3** failure of the Contractor to make payments properly to Subcontractors or for labor, materials or equipment;
- **.4** reasonable evidence that the Work cannot be completed for the unpaid balance of the Contract Sum;
- **.5** damage to the Owner or a separate contractor;
- **.6** reasonable evidence that the Work will not be completed within the Contract Time, and that the unpaid balance would not be adequate to cover actual or liquidated damages for the anticipated delay;
- **.7** failure to carry out the Work in accordance with the Contract Documents; or
- **.8** any other failure to comply with the obligations of the Contractor under the Contract Documents.

§ 9.5.2 When the above reasons for withholding certification are removed, certification will be made for amounts previously withheld.

§ 9.5.3 If the Design Agent withholds certification for payment under Section 9.5.1.3, the Owner may, at its sole option, issue joint checks to the Contractor and to any Subcontractor or material or equipment suppliers to whom the

Contractor failed to make payment for Work properly performed or material or equipment suitably delivered. If the Owner makes payments by joint check, the Owner shall notify the Design Agent and the Design Agent will reflect such payment on the next Certificate for Payment.

§ 9.6 PROGRESS PAYMENTS

§ 9.6.1 After the Design Agent has issued a Certificate for Payment and the Owner has approved the Certificate for Payment in writing, the Owner shall make payment in the manner and within the time provided in the Contract Documents, and shall so notify the Design Agent.

§ 9.6.2 The Contractor shall pay each Subcontractor no later than 10 working days after receipt of payment from the Owner the amount to which the Subcontractor is entitled, reflecting percentages actually retained from payments to the Contractor on account of the Subcontractor's portion of the Work. The Contractor shall, by appropriate agreement with each Subcontractor, require each Subcontractor to make payments to Sub-subcontractors in a similar manner.

§ 9.6.3 The Design Agent will, on request, furnish to a Subcontractor, if practicable, information regarding percentages of completion or amounts applied for by the Contractor and action taken thereon by the Design Agent and Owner on account of portions of the Work done by such Subcontractor.

§ 9.6.4 The Owner has the right to request written evidence from the Contractor that the Contractor has properly paid Subcontractors and material and equipment suppliers amounts paid by the Owner to the Contractor for subcontracted Work. If the Contractor fails to furnish such evidence within 7 working days, the Owner shall have the right to contact Subcontractors to ascertain whether they have been properly paid. The Owner shall have the right to withhold payment(s) to the Contractor in the event that any Subcontractors or material and equipment suppliers have not been properly paid. Neither the Owner nor Design Agent shall have an obligation to pay or to see to the payment of money to a Subcontractor, except as may otherwise be required by law.

§ 9.6.5 Contractor payments to material and equipment suppliers shall be treated in a manner similar to that provided in Sections 9.6.2, 9.6.3 and 9.6.4.

§ 9.6.6 A Certificate for Payment, a progress payment, or partial or entire use or occupancy of the Project by the Owner shall not constitute acceptance of Work not in accordance with the Contract Documents.

§ 9.6.7 Unless the Contractor provides the Owner with a payment bond in the full penal sum of the Contract Sum, payments received by the Contractor for Work properly performed by Subcontractors and suppliers shall be held by the Contractor for those Subcontractors or suppliers who performed Work or furnished materials, or both, under contract with the Contractor for which payment was made by the Owner. Nothing contained herein shall require money to be placed in a separate account and not commingled with money of the Contractor, shall create any fiduciary liability or tort liability on the part of the Contractor for breach of trust or shall entitle any person or entity to an award of punitive damages against the Contractor for breach of the requirements of this provision.

§ 9.7 FAILURE OF PAYMENT

If the Design Agent does not issue a Certificate for Payment, through no fault of the Contractor, within 7 working days after receipt of the Contractor's Application for Payment, or if the Owner does not pay the Contractor within 7 working days after the date established in the Contract Documents the amount certified by the Design Agent or awarded by binding dispute resolution, then the Contractor may, upon 7 additional working days' written notice to the Owner and Design Agent, make a claim for payment as provided under the provisions of applicable law.

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§ 9.8 SUBSTANTIAL COMPLETION

§ 9.8.1 Substantial Completion is the stage in the progress of the Work when the Work or designated portion thereof is sufficiently complete in accordance with the Contract Documents so that the Owner can occupy or utilize the Work for its intended use.

§ 9.8.2 When the Contractor considers that the Work, or a portion thereof which the Owner agrees to accept separately, is substantially complete, the Contractor shall prepare and submit to the Design Agent a comprehensive list of items to be completed or corrected prior to final payment. Failure to include an item on such list does not alter the responsibility of the Contractor to complete all Work in accordance with the Contract Documents.

§ 9.8.3 Upon receipt of the Contractor's list, the Design Agent will make an inspection to determine whether the Work or designated portion thereof is substantially complete. If the Design Agent's inspection discloses any item, whether or not included on the Contractor's list, which is not sufficiently complete in accordance with the Contract Documents so that the Owner can occupy or utilize the Work or designated portion thereof for its intended use, the Contractor shall, before issuance of the Certificate of Substantial Completion, complete or correct such item upon notification by the Design Agent. In such case, the Contractor shall then submit a request for another inspection by the Design Agent to determine Substantial Completion. The Design Agent will perform no more than 2 inspections to determine whether the Work or a designated portion thereof has attained Substantial Completion in accordance with the Contract Documents. The Owner is entitled to reimbursement from the Contractor for amounts paid to the Design Agent for any additional inspections.

§ 9.8.4 When the Work or designated portion thereof is substantially complete, the Design Agent will prepare a Certificate of Substantial Completion that shall establish the date of Substantial Completion, shall establish responsibilities of the Owner and Contractor for security, maintenance, heat, utilities, damage to the Work and insurance, and shall fix the time within which the Contractor shall finish all items on the list accompanying the Certificate.

§ 9.8.5 The Certificate of Substantial Completion shall be submitted to the Owner and Contractor for their written acceptance of responsibilities assigned to them in such Certificate. Upon such acceptance and consent of surety, if any, the Owner shall make payment less the amount of five (5%) percent to be retained by the Owner until the first anniversary of Final Completion of the Work. Such payment shall be adjusted for Work that is incomplete or not in accordance with the requirements of the Contract Documents.

§ 9.9 PARTIAL OCCUPANCY OR USE

§ 9.9.1 The Owner may occupy or use any completed or partially completed portion of the Work at any stage when such portion is designated by separate agreement with the Contractor, provided such occupancy or use is consented to by the insurer as required under Section 11.3.1.5 and authorized by public authorities having jurisdiction over the Project. Such partial occupancy or use may commence whether or not the portion is substantially complete, provided the Owner and Contractor have accepted in writing the responsibilities assigned to each of them for payments, retainage, if any, security, maintenance, heat, utilities, damage to the Work and insurance, and have agreed in writing concerning the period for correction of the Work and commencement of warranties required by the Contract Documents. When the Contractor considers a portion substantially complete, the Contractor shall prepare and submit a list to the Design Agent as provided under Section 9.8.2. Consent of the Contractor to partial occupancy or use shall not be unreasonably withheld. The stage of the progress of the Work shall be determined by written agreement between the Owner and Contractor or, if no agreement is reached, by decision of the Design Agent.

§ 9.9.2 Immediately prior to such partial occupancy or use, the Owner, Contractor and Design Agent shall jointly inspect the area to be occupied or portion of the Work to be used in order to determine and record the condition of the Work.

§ 9.9.3 Unless otherwise agreed upon, partial occupancy or use of a portion or portions of the Work shall not constitute acceptance of Work not complying with the requirements of the Contract Documents.

§ 9.10 FINAL COMPLETION AND FINAL PAYMENT

§ 9.10.1 Upon receipt of the Contractor's written notice that the Work is ready for final inspection and acceptance and upon receipt of a final Application for Payment, the Design Agent will promptly make such inspection and, when the Design Agent finds the Work acceptable under the Contract Documents and the Contract fully performed, the Design Agent will promptly issue a final Certificate for Payment stating that to the best of the Design Agent's knowledge, information and belief, and on the basis of the Design Agent's on-site visits and inspections, the Work has been completed in accordance with terms and conditions of the Contract Documents and that the entire balance found to be due the Contractor and noted in the final Certificate is due and payable. The Design Agent's final Certificate for Payment will constitute a further representation that conditions listed in Section 9.10.2 as precedent to the Contractor's being entitled to final payment have been fulfilled. The Design Agent will perform no more than 2 inspections to determine whether the Work or a designated portion thereof has attained Final Completion in accordance with the Contract Documents. The Owner is entitled to reimbursement from the Contractor for amounts paid to the Design Agent for any additional inspections.

§ 9.10.2 Neither final payment nor any remaining retained percentage shall become due until the Contractor submits to the Design Agent (1) an affidavit that payrolls, bills for materials and equipment, and other indebtedness connected with the Work for which the Owner or the Owner's property might be responsible or encumbered (less amounts withheld by Owner) have been paid or otherwise satisfied, (2) a certificate evidencing that insurance required by the Contract Documents to remain in force after final payment is currently in effect and will not be canceled or allowed to expire until at least 30 working days' prior written notice has been given to the Owner, (3) a written statement that the Contractor knows of no substantial reason that the insurance will not be renewable to cover the period required by the Contract Documents, (4) consent of surety, if any, to final payment, (5), if required by the Owner, other data establishing payment or satisfaction of obligations, such as receipts, releases and waivers of liens, claims, security interests or encumbrances arising out of the Contract, to the extent and in such form as may be designated by the Owner, and (6) all other close-out documents required by the Owner, including without limitation, all as-built plans, warranties, manuals, and other materials set forth in the Contract Documents. If a Subcontractor refuses to furnish a release or waiver required by the Owner, the Contractor may furnish a bond satisfactory to the Owner to indemnify the Owner against such lien. If such lien remains unsatisfied after payments are made, the Contractor shall refund to the Owner all money that the Owner may be compelled to pay in discharging such lien, including all costs and reasonable attorneys' fees.

§ 9.10.3 If, after Substantial Completion of the Work, final completion thereof is materially delayed through no fault of the Contractor or by issuance of Change Orders affecting final completion, and the Design Agent so confirms, the Owner shall, upon application by the Contractor and certification by the Design Agent, and without terminating the Contract, make payment of the balance due for that portion of the Work fully completed and accepted. If the remaining balance for Work not fully completed or corrected is less than retainage stipulated in the Contract Documents, and if bonds have been furnished, the written consent of surety to payment of the balance due for that portion of the Work fully completed and accepted shall be submitted by the Contractor to the Design Agent prior to certification of such payment. Such payment shall be made under terms and conditions governing final payment, except that it shall not constitute a waiver of claims.

§ 9.10.4 The making of final payment shall constitute a waiver of Claims by the Owner except those arising from:

- **.1** liens, Claims, security interests, or encumbrances arising out of the Contract and unsettled;
- **.2** failure of the Work to comply with the requirements of the Contract Documents;
- **.3** terms of special warranties required by the Contract Documents; or
- **.4** claims permitted under the State of Rhode Island General Conditions of Purchase Regulation.

§ 9.10.5 Acceptance of final payment by the Contractor, a Subcontractor or material supplier shall constitute a waiver of claims by that payee except those previously made in writing and identified by that payee as unsettled at the time of final Application for Payment.

§ 9.11 The Contractor and the Contractor's surety shall be liable for and shall pay the Owner as liquidated damages the sums specified in the Solicitation and Bid Form, or if completed, the amount set forth in Section 3.4 of the Agreement.

§ 9.12 Warranties required by the Contract Documents shall commence on the date of Final Completion of the Work.

ARTICLE 10 PROTECTION OF PERSONS AND PROPERTY

§ 10.1 SAFETY PRECAUTIONS AND PROGRAMS

The Contractor shall be responsible for initiating, maintaining and supervising all safety precautions and programs in connection with the performance of the Contract.

§ 10.2 SAFETY OF PERSONS AND PROPERTY

§ 10.2.1 The Contractor shall take reasonable precautions for safety of, and shall provide reasonable protection to prevent damage, injury or loss to:

- **.1** employees on the Work and other persons who may be affected thereby;
- **.2** the Work and materials and equipment to be incorporated therein, whether in storage on or off the site, under care, custody or control of the Contractor or the Contractor's Subcontractors or Sub-subcontractors; and
- **.3** other property at the site or adjacent thereto, such as trees, shrubs, lawns, walks, pavements, roadways, structures and utilities not designated for removal, relocation or replacement in the course of construction.

§ 10.2.2 The Contractor shall comply with and give notices required by applicable laws, statutes, ordinances, codes, rules and regulations, and lawful orders of public authorities bearing on safety of persons or property or their protection from damage, injury or loss.

§ 10.2.3 The Contractor shall erect and maintain, as required by existing conditions and performance of the Contract, reasonable safeguards for safety and protection, including posting danger signs and other warnings against hazards, promulgating safety regulations and notifying owners and users of adjacent sites and utilities.

§ 10.2.4 When use or storage of explosives or other hazardous materials or equipment or unusual methods are necessary for execution of the Work, the Contractor shall exercise utmost care and carry on such activities under supervision of properly qualified personnel and in consultation with the appropriate governmental authorities.

§ 10.2.4.1 When use or storage of explosives, or other hazardous materials, substances or equipment, or unusual methods are necessary for execution of the Work, the Contractor shall give the User Agency and the Owner reasonable advance notice.

§ 10.2.4.2 If the Contract Documents require the Contractor to handle materials or substances that under certain circumstances may be designated as hazardous, the Contractor shall handle such materials in an appropriate manner.

§ 10.2.5 The Contractor shall promptly remedy damage and loss (other than damage or loss insured under property insurance required by the Contract Documents) to property referred to in Sections 10.2.1.2 and 10.2.1.3 caused in whole or in part by the Contractor, a Subcontractor, a Sub-subcontractor, or anyone directly or indirectly employed by any of them, or by anyone for whose acts they may be liable and for which the Contractor is responsible under Sections 10.2.1.2 and 10.2.1.3, except damage or loss attributable to acts or omissions of the Owner or Design Agent or anyone directly or indirectly employed by either of them, or by anyone for whose acts either of them may be liable, and not attributable to the fault or negligence of the Contractor. The foregoing obligations of the Contractor are in addition to the Contractor's obligations under Section 3.18.

§ 10.2.6 The Contractor shall designate a responsible member of the Contractor's organization at the site whose duty shall be the prevention of accidents. This person shall be the Contractor's superintendent unless otherwise designated by the Contractor in writing to the Owner and Design Agent.

§ 10.2.7 The Contractor shall not permit any part of the construction or site to be loaded so as to cause damage or create an unsafe condition.

§ 10.2.8 INJURY OR DAMAGE TO PERSON OR PROPERTY

If either party suffers injury or damage to person or property because of an act or omission of the other party, or of others for whose acts such party is legally responsible, written notice of such injury or damage, whether or not insured, shall be given to the other party within a reasonable time. The notice shall provide sufficient detail to enable the other party to investigate the matter.

§ 10.3 HAZARDOUS MATERIALS

§ 10.3.1 The Contractor is responsible for compliance with any requirements included in the Contract Documents regarding hazardous materials. If the Contractor encounters a hazardous material or substance not addressed in the Contract Documents and if reasonable precautions will be inadequate to prevent foreseeable bodily injury or death to persons resulting from a material or substance, including but not limited to asbestos or polychlorinated biphenyl (PCB), encountered on the site by the Contractor, the Contractor shall, upon recognizing the condition, immediately stop Work in the affected area and report the condition to the Owner and Design Agent in writing.

§ 10.3.2 Upon receipt of the Contractor's written notice, the Owner shall obtain the services of a licensed laboratory to verify the presence or absence of the material or substance reported by the Contractor and, in the event such material or substance is found to be present, to cause it to be rendered harmless. Unless otherwise required by the Contract Documents, the Owner shall furnish in writing to the Contractor and Design Agent the names and qualifications of persons or entities who are to perform tests verifying the presence or absence of such material or substance or who are to perform the task of removal or safe containment of such material or substance. The Contractor and the Design Agent will promptly reply to the Owner in writing stating whether or not either has reasonable objection to the persons

or entities proposed by the Owner. If either the Contractor or Design Agent has an objection to a person or entity proposed by the Owner, the Owner shall propose another to whom the Contractor and the Design Agent have no reasonable objection. When the material or substance has been rendered harmless, Work in the affected area shall resume upon written agreement of the Owner and Contractor. By Change Order, the Contract Time shall be extended appropriately and the Contract Sum shall be increased in the amount of the Contractor's reasonable additional costs of shut-down, delay and start-up.

§ 10.3.3 To the extent permitted by the provisions of R.I. Gen. Laws §§ 9-31-1 et seq., the Owner shall indemnify and hold harmless the Contractor, Subcontractors, Design Agent, Design Agent's consultants and agents and employees of any of them from and against claims, damages, losses and expenses, including but not limited to attorneys' fees, arising out of or resulting from performance of the Work in the affected area if in fact the material or substance presents the risk of bodily injury or death as described in Section 10.3.1 and has not been rendered harmless, provided that such claim, damage, loss or expense is attributable to bodily injury, sickness, disease or death, or to injury to or destruction of tangible property (other than the Work itself), except to the extent that such damage, loss or expense is due to the fault or negligence of the party seeking indemnity.

§ 10.3.4 The Owner shall not be responsible under this Section 10.3 for materials or substances the Contractor brings to the site unless such materials or substances are required by the Contract Documents. The Owner shall be responsible for materials or substances required by the Contract Documents, except to the extent of the Contractor's fault or negligence in the use and handling of such materials or substances.

§ 10.3.5 The Contractor shall indemnify the Owner for the cost and expense the Owner incurs (1) for remediation of a material or substance the Contractor brings to the site and negligently handles, or (2) where the Contractor fails to perform its obligations under Section 10.3.1, except to the extent that the cost and expense are due to the Owner's fault or negligence.

§ 10.3.6 If, without negligence on the part of the Contractor, the Contractor is held liable by a government agency for the cost of remediation of a hazardous material or substance solely by reason of performing Work as required by the Contract Documents, the Owner shall indemnify the Contractor for all cost and expense thereby incurred.

§ 10.4 EMERGENCIES

In an emergency affecting safety of persons or property, the Contractor shall act, at the Contractor's discretion, to prevent threatened damage, injury or loss. Additional compensation or extension of time claimed by the Contractor on account of an emergency shall be determined as provided in Article 15 and Article 7.

ARTICLE 11 INSURANCE AND BONDS

§ 11.1 CONTRACTOR'S LIABILITY INSURANCE

§ 11.1.1 The Contractor shall purchase from and maintain in a company or companies lawfully authorized to do business in the jurisdiction in which the Project is located such insurance as is specified in the Solicitation and as will protect the Contractor from claims set forth below which may arise out of or result from the Contractor's operations and completed operations under the Contract and for which the Contractor may be legally liable, whether such operations be by the Contractor or by a Subcontractor or by anyone directly or indirectly employed by any of them, or by anyone for whose acts any of them may be liable:

- **.1** Claims under workers' compensation, disability benefit and other similar employee benefit acts that are applicable to the Work to be performed;
- **.2** Claims for damages because of bodily injury, occupational sickness or disease, or death of the Contractor's employees;
- **.3** Claims for damages because of bodily injury, sickness or disease, or death of any person other than the Contractor's employees;
- **.4** Claims for damages insured by usual personal injury liability coverage;
- **.5** Claims for damages, other than to the Work itself, because of injury to or destruction of tangible property, including loss of use resulting therefrom;
- **.6** Claims for damages because of bodily injury, death of a person or property damage arising out of ownership, maintenance or use of a motor vehicle;
- **.7** Claims for bodily injury or property damage arising out of completed operations; and
- **.8** Claims involving contractual liability insurance applicable to the Contractor's obligations under Section 3.18.

§ 11.1.1.2 The Contractor's liability insurance shall include all major coverages and be on a comprehensive general liability basis.

§ 11.1.2 The insurance required by Section 11.1.1 shall be written for not less than limits of liability specified in the Contract Documents or required by law, whichever coverage is greater. Coverages, whether written on an occurrence or claims-made basis, shall be maintained without interruption from the date of commencement of the Work until the date of final payment and termination of any coverage required to be maintained after final payment, and, with respect to the Contractor's completed operations coverage, until the expiration of the period for correction of Work or for such other period for maintenance of completed operations coverage as specified in the Contract Documents.

§ 11.1.3 Certificates of insurance as specified in the Solicitation and as otherwise acceptable to the Owner shall be filed with the Owner and the User Agency prior to commencement of the Work and thereafter upon renewal or replacement of each required policy of insurance. These certificates and the insurance policies required by this Section 11.1 shall contain a provision that coverages afforded under the policies will not be canceled or allowed to expire until at least 30 working days' prior written notice has been given to the Owner and the User Agency. An additional certificate evidencing continuation of liability coverage, including coverage for completed operations, shall be submitted with the final Application for Payment as required by Section 9.10.2 and thereafter upon renewal or replacement of such coverage until the expiration of the time required by Section 11.1.2. Information concerning reduction of coverage on account of revised limits or claims paid under the General Aggregate, or both, shall be furnished by the Contractor with reasonable promptness.

§ 11.1.4 The Contractor shall cause the commercial liability coverage required by the Contract Documents to include (1) the Owner, the User Agency, and their elected and appointed officials, members, employees, and agents, the Design Agent and the Design Agent's consultants as additional insureds for claims caused in whole or in part by the Contractor's acts or omissions during the Contractor's operations; and (2) the Owner, the User Agency, and their elected and appointed officials, members, employees, and agents, as additional insureds for claims caused in whole or in part by the Contractor's negligent acts or omissions during the Contractor's completed operations.

§ 11.1.5 The Contractor shall be responsible for the prompt payment to the Owner of any deductible amounts under any insurance policies required under the Contract Documents for claims made pursuant to such policies.

§ 11.2 OWNER'S LIABILITY INSURANCE.

§ 11.2.1 The Contractor shall furnish the Owner and the User Agency, through the Design Agent, an insurance certificate providing Owner's Protective Liability extended to include the interests of the Design Agent, and to protect the Owner, User Agency, and Design Agent from any liability which might be incurred against any of them as a result of any operation of the Contractor or Subcontractors or their employees or anyone for whom either the Contractor or Subcontractors are responsible. Such insurance shall be written for the same limits as the Contractor's comprehensive general liability insurance and shall include the same coverage.

§ 11.2.2 If the Owner engages separate contractors to perform work for, or in or around, the Project, it shall require in its contracts with each separate contractor that Contractor and its officers, directors, partners, members, employees, and agents shall be: (i) named as additional insureds on a primary, noncontributory basis to any commercial general liability, pollution liability, and excess liability insurance policies; and (ii) provided a waiver of subrogation on all workers compensation and professional liability insurance policies.

§ 11.3 PROPERTY INSURANCE

§ 11.3.1 The Contractor shall purchase and maintain, in a company or companies lawfully authorized to do business in the state of Rhode Island, property insurance written on a builder's risk "all-risk" or equivalent policy form in the amount of the initial Contract Sum, plus value of subsequent Contract Modifications and cost of materials supplied or installed by others, comprising total value for the entire Project at the site on a replacement cost basis without optional deductibles. Such property insurance shall be maintained, unless otherwise provided in the Contract Documents or otherwise agreed in writing by all persons and entities who are beneficiaries of such insurance, until final payment has been made as provided in Section 9.10 or until no person or entity other than the Owner has an insurable interest in the property required by this Section 11.3 to be covered, whichever is later. This insurance shall include interests of the Owner, the User Agency, the Contractor, Subcontractors and Sub-subcontractors in the Project. If the Owner and/or

the User Agency incur any damages by failure of the Contractor to maintain such insurance, then the Contractor shall bear all reasonable cost resulting from such failure.

§ 11.3.1.1 Property insurance shall be on an "all-risk" or equivalent policy form and shall include, without limitation, insurance against the perils of fire (with extended coverage) and physical loss or damage including, without duplication of coverage, theft, vandalism, malicious mischief, collapse, earthquake, flood, windstorm, falsework, testing and startup, temporary buildings and debris removal including demolition occasioned by enforcement of any applicable legal requirements, and shall cover reasonable compensation for Design Agent's and Contractor's services and expenses required as a result of such insured loss.

§ 11.3.1.2 Deleted.

§ 11.3.1.3 If the property insurance requires deductibles, the Owner shall pay costs not covered because of such deductibles.

§ 11.3.1.4 This property insurance shall cover portions of the Work stored off the site, and also portions of the Work in transit.

§ 11.3.1.5 Partial occupancy or use in accordance with Section 9.9 shall not commence until the insurance company or companies providing property insurance have consented to such partial occupancy or use by endorsement or otherwise. The Contractor shall take reasonable steps to obtain consent of the insurance company or companies and shall, without mutual written consent, take no action with respect to partial occupancy or use that would cause cancellation, lapse or reduction of insurance.

§ 11.3.2 Deleted.

§ 11.3.3 Deleted.

§ 11.3.4 Deleted.

§ 11.3.5 If during the Project construction period the Owner insures properties, real or personal or both, at or adjacent to the site by property insurance under policies separate from those insuring the Project, or if after final payment property insurance is to be provided on the completed Project through a policy or policies other than those insuring the Project during the construction period, the Owner shall waive all rights in accordance with the terms of Section 11.3.7 for damages caused by fire or other causes of loss covered by this separate property insurance. All separate policies shall provide this waiver of subrogation by endorsement or otherwise.

§ 11.3.6 Before an exposure to loss may occur, the Contractor shall file with the Owner a copy of each policy that includes insurance coverages required by this Section 11.3. Each policy shall contain all generally applicable conditions, definitions, exclusions and endorsements related to this Project. Each policy shall contain a provision that the policy will not be canceled or allowed to expire, and that its limits will not be reduced, until at least 30 working days' prior written notice has been given to the Owner and the User Agency.

§ 11.3.7 WAIVERS OF SUBROGATION

The Contractor waives all rights against the Owner and the User Agency and any of their subcontractors, sub-subcontractors, agents and employees, and (2) the Design Agent, Design Agent's consultants, separate contractors described in Article 6, if any, and any of their subcontractors, sub-subcontractors, agents and employees, for damages caused by fire or other causes of loss to the extent covered by property insurance obtained pursuant to this Section 11.3 or other property insurance applicable to the Work, except such rights as they have to proceeds of such insurance held by the Owner as fiduciary. The Owner or Contractor, as appropriate, shall require of the Design Agent, Design Agent's consultants, separate contractors described in Article 6, if any, and the subcontractors, sub-subcontractors, agents and employees of any of them, by appropriate agreements, written where legally required for validity, similar waivers each in favor of other parties enumerated herein. The policies shall provide such waivers of subrogation by endorsement or otherwise. A waiver of subrogation shall be effective as to a person or entity even though that person or entity would otherwise have a duty of indemnification, contractual or otherwise, did not pay the insurance premium directly or indirectly, and whether or not the person or entity had an insurable interest in the property damaged.

§ 11.3.8 A loss insured under this property insurance shall be adjusted by the Contractor as fiduciary and made payable to the Owner as fiduciary for the insureds, as their interests may appear, subject to requirements of any applicable mortgagee clause and of Section 11.3.10. The Contractor shall pay Subcontractors their just shares of insurance proceeds received by the Contractor, and by appropriate agreements, written where legally required for validity, shall require Subcontractors to make payments to their Sub-subcontractors in similar manner.

§ 11.3.9 If required in writing by a party in interest, the Owner as fiduciary shall, upon occurrence of an insured loss, give bond for proper performance of the Contractor's duties. The cost of required bonds shall be charged against proceeds received as fiduciary. The Contractor shall deposit in a separate account proceeds so received, which the Contractor shall distribute in accordance with such agreement as the parties in interest may reach, or as determined in accordance with the method of binding dispute resolution selected in the Agreement between the Owner and Contractor. If after such loss no other special agreement is made and unless the Owner terminates the Contract for convenience, replacement of damaged property shall be performed by the Contractor after notification of a Change in the Work in accordance with Article 7.

§ 11.3.10 The Contractor as fiduciary shall have power to adjust and settle a loss with insurers unless one of the parties in interest shall object in writing within 5 working days after occurrence of loss to the Contractor's exercise of this power; if such objection is made, the dispute shall be resolved in the manner selected by the Owner and Contractor as the method of binding dispute resolution in the Agreement.

§ 11.4 PERFORMANCE BOND AND PAYMENT BOND

§ 11.4.1 The Contractor shall furnish bonds covering faithful performance of the Contract and payment of obligations arising thereunder as stipulated in the Solicitation.

§ 11.4.2 Upon the request of any person or entity appearing to be a potential beneficiary of bonds covering payment of obligations arising under the Contract, the Contractor shall promptly furnish a copy of the bonds or shall authorize a copy to be furnished.

ARTICLE 12 UNCOVERING AND CORRECTION OF WORK

§ 12.1 UNCOVERING OF WORK

§ 12.1.1 If a portion of the Work is covered contrary to the Design Agent's request or to requirements specifically expressed in the Contract Documents, it must, if requested in writing by the Design Agent, be uncovered for the Design Agent's examination and be replaced at the Contractor's expense without change in the Contract Time.

§ 12.1.2 If a portion of the Work has been covered that the Design Agent has not specifically requested to examine prior to its being covered, the Design Agent may request to see such Work and it shall be uncovered by the Contractor. If such Work is in accordance with the Contract Documents, costs of uncovering and replacement shall, by appropriate Change Order, be at the Owner's expense. If such Work is not in accordance with the Contract Documents, such costs and the cost of correction shall be at the Contractor's expense unless the condition was caused by the Owner or a separate contractor in which event the Owner shall be responsible for payment of such costs.

§ 12.2 CORRECTION OF WORK

§ 12.2.1 BEFORE OR AFTER SUBSTANTIAL COMPLETION

The Contractor shall promptly correct Work rejected by the Design Agent or failing to conform to the requirements of the Contract Documents, whether discovered before or after Substantial Completion and whether or not fabricated, installed or completed. Costs of correcting such rejected Work, including additional testing and inspections, the cost of uncovering and replacement, and compensation for the Design Agent's services and expenses made necessary thereby, shall be at the Contractor's expense.

§ 12.2.2 AFTER SUBSTANTIAL COMPLETION

§ 12.2.2.1 In addition to the Contractor's obligations under Section 3.5, if, within one year after the date of Final Completion of the Work or designated portion thereof or after the date for commencement of warranties established under Section 9.9.1, or by terms of an applicable special warranty required by the Contract Documents, any of the Work is found to be not in accordance with the requirements of the Contract Documents, the Contractor shall correct it promptly after receipt of written notice from the Owner to do so unless the Owner has previously given the Contractor a written acceptance of such condition. The Owner shall give such notice promptly after discovery of the condition. If

the Contractor fails to correct nonconforming Work within a reasonable time after receipt of notice from the Owner or Design Agent, the Owner may correct it in accordance with Section 2.4.

§ 12.2.2.2 The one-year period for correction of Work shall be extended with respect to portions of Work first performed after Substantial Completion by the period of time between Substantial Completion and the actual completion of that portion of the Work.

§ 12.2.2.3 The one-year period for correction of Work shall not be extended by corrective Work performed by the Contractor pursuant to this Section 12.2.

§ 12.2.2.4 Upon request by the Owner and prior to the expiration of one year from the date of Final Completion, the Design Agent will conduct and the Contractor shall attend 2 meetings with the Owner to review the facility operations and performance.

§ 12.2.3 The Contractor shall remove from the site portions of the Work that are not in accordance with the requirements of the Contract Documents and are neither corrected by the Contractor nor accepted by the Owner.

§ 12.2.4 The Contractor shall bear the cost of correcting destroyed or damaged construction, whether completed or partially completed, of the Owner or separate contractors caused by the Contractor's correction or removal of Work that is not in accordance with the requirements of the Contract Documents.

§ 12.2.5 Nothing contained in this Section 12.2 shall be construed to establish a period of limitation with respect to other obligations the Contractor has under the Contract Documents. Establishment of the one-year period for correction of Work as described in Section 12.2.2 relates only to the specific obligation of the Contractor to correct the Work, and has no relationship to the time within which the obligation to comply with the Contract Documents may be sought to be enforced, nor to the time within which proceedings may be commenced to establish the Contractor's liability with respect to the Contractor's obligations other than specifically to correct the Work.

§ 12.3 ACCEPTANCE OF NONCONFORMING WORK

If the Owner prefers to accept Work that is not in accordance with the requirements of the Contract Documents, the Owner may do so instead of requiring its removal and correction, in which case the Contract Sum will be reduced as appropriate and equitable. Such adjustment shall be effected whether or not final payment has been made.

ARTICLE 13 MISCELLANEOUS PROVISIONS

§ 13.1 GOVERNING LAW

The Contract shall be governed by the law of the State of Rhode Island.

§ 13.2 SUCCESSORS AND ASSIGNS

§ 13.2.1 The Owner and Contractor respectively bind themselves, their successors, assigns and legal representatives to covenants, agreements and obligations contained in the Contract Documents. Except as provided in Section 13.2.2, neither party to the Contract shall assign the Contract as a whole without written consent of the other. If either party attempts to make such an assignment without such consent, that party shall nevertheless remain legally responsible for all obligations under the Contract.

§ 13.2.2 The Owner may, without consent of the Contractor, assign the Contract to any executive, legislative, judicial, regulatory, or administrative body of the state, or any political subdivision thereof, including without limitation, any department, division, agency, commission, board, office, bureau, authority, school, water, or fire district, or other agency of Rhode Island state or local government that exercises governmental functions, any other governmental authority, and any quasi-public corporation and/or body corporate and politic. The Contractor shall execute all consents reasonably required to facilitate such assignment.

§ 13.3 WRITTEN NOTICE

Written notice shall be deemed to have been duly served if delivered in person to the individual, to a member of the firm or entity, or to an officer of the corporation for which it was intended; or if delivered at, or sent by registered or certified mail or by courier service providing proof of delivery to, the last business address known to the party giving notice, or when received, if manually delivered or transmitted by electronic mail or facsimile to the last such address known to the party giving notice.

§ 13.4 RIGHTS AND REMEDIES

§ 13.4.1 Duties and obligations imposed by the Contract Documents and rights and remedies available thereunder shall be in addition to and not a limitation of duties, obligations, rights and remedies otherwise imposed or available by law.

§ 13.4.2 No action or failure to act by the Owner, Design Agent or Contractor shall constitute a waiver of a right or duty afforded them under the Contract, nor shall such action or failure to act constitute approval of or acquiescence in a breach there under, except as may be specifically agreed in writing.

§ 13.5 TESTS AND INSPECTIONS

§ 13.5.1 Tests, inspections and approvals of portions of the Work shall be made as required by the Contract Documents and by applicable laws, statutes, ordinances, codes, rules and regulations or lawful orders of public authorities. Unless otherwise provided, the Contractor shall make arrangements for such tests, inspections and approvals with an independent testing laboratory or entity acceptable to the Owner, or with the appropriate public authority, and shall bear all related costs of tests, inspections and approvals. The Contractor shall give the Design Agent timely notice of when and where tests and inspections are to be made so that the Design Agent may be present for such procedures. The Owner shall bear costs of (1) tests, inspections or approvals that do not become requirements until after bids are received or negotiations concluded, and (2) tests, inspections or approvals where building codes or applicable laws or regulations prohibit the Owner from delegating their cost to the Contractor.

§ 13.5.2 If the Design Agent, Owner or public authorities having jurisdiction determine that portions of the Work require additional testing, inspection or approval not included under Section 13.5.1, the Design Agent will, upon written authorization from the Owner, instruct the Contractor to make arrangements for such additional testing, inspection or approval by an entity acceptable to the Owner, and the Contractor shall give timely notice to the Design Agent of when and where tests and inspections are to be made so that the Design Agent may be present for such procedures. Such costs, except as provided in Section 13.5.3, shall be at the Owner's expense.

§ 13.5.3 If such procedures for testing, inspection or approval under Sections 13.5.1 and 13.5.2 reveal failure of the portions of the Work to comply with requirements established by the Contract Documents, all costs made necessary by such failure including those of repeated procedures and compensation for the Design Agent's services and expenses shall be at the Contractor's expense.

§ 13.5.4 Required certificates of testing, inspection or approval shall, unless otherwise required by the Contract Documents, be secured by the Contractor and promptly delivered to the Design Agent.

§ 13.5.5 If the Design Agent is to observe tests, inspections or approvals required by the Contract Documents, the Design Agent will do so promptly and, where practicable, at the normal place of testing.

§ 13.5.6 Tests or inspections conducted pursuant to the Contract Documents shall be made promptly to avoid unreasonable delay in the Work.

§ 13.6 INTEREST

No interest shall be due or payable on account of any payment due or unpaid under the Contract Documents except in accordance with the provisions of "Prompt Payment by Department of Administration," R.I. Gen. Laws §§ 42-11.1-1 et seq.

§ 13.7 TIME LIMITS ON CLAIMS

The Owner and Contractor shall commence all claims and causes of action, whether in contract, tort, breach of warranty or otherwise, against the other arising out of or related to the Contract in accordance with the requirements of the final dispute resolution method selected in the Agreement within the time period specified by applicable law. The Owner and Contractor waive all claims and causes of action not commenced in accordance with this Section 13.7.

ARTICLE 14 TERMINATION OR SUSPENSION OF THE CONTRACT

§ 14.1 TERMINATION BY THE CONTRACTOR

§ 14.1.1 The Contractor may terminate the Contract if the Work is stopped for a period of 30 calendar days through no act or fault of the Contractor or a Subcontractor, Sub-subcontractor or their agents or employees or any other persons

or entities performing portions of the Work under direct or indirect contract with the Contractor, for any of the following reasons:

.1 Issuance of an order of a court or other public authority having jurisdiction that requires all Work to be stopped;

.2 An act of government, such as a declaration of national emergency that requires all Work to be stopped; or

.3 Because the Design Agent has not issued a Certificate for Payment and has not notified the Contractor of the reason for withholding certification as provided in Section 9.4.1

§ 14.1.2 Deleted.

§ 14.1.3 If one of the reasons described in Section 14.1.1 exists, the Contractor may, upon 7 working days' written notice to the Owner and Design Agent, terminate the Contract and recover from the Owner payment for Work executed.

§ 14.1.4 If the Work is stopped for a period of 60 calendar days through no act or fault of the Contractor or a Subcontractor or their agents or employees or any other persons performing portions of the Work under contract with the Contractor because the Owner has repeatedly failed to fulfill the Owner's obligations under the Contract Documents with respect to matters important to the progress of the Work, the Contractor may, upon 7 additional days' written notice to the Owner and the Design Agent, terminate the Contract and recover from the Owner as provided in Section 14.1.3.

§ 14.2 TERMINATION BY THE OWNER FOR CAUSE

§ 14.2.1 The Owner may terminate the Contract if the Contractor:

.1 refuses or fails to supply enough properly skilled workers or proper materials;

.2 fails to make payment to Subcontractors for materials or labor in accordance with the respective agreements between the Contractor and the Subcontractors;

.3 disregards or fails to comply with applicable laws, statutes, ordinances, codes, rules and regulations, or lawful orders of a public authority;

.4 otherwise is guilty of breach of a provision of the Contract Documents; or

.5 cancels or the Contractor or the Owner receives notice of cancellation or nonrenewal of any insurance required under the Contract Documents.

§ 14.2.2 When any of the above reasons exist, the Owner, upon certification by the Initial Decision Maker that sufficient cause exists to justify such action, may without prejudice to any other rights or remedies of the Owner and after giving the Contractor and the Contractor's surety, if any, 7 working days' written notice, terminate employment of the Contractor and may, subject to any prior rights of the surety:

.1 Exclude the Contractor from the site and take possession of all materials, equipment, tools, and construction equipment and machinery thereon owned by the Contractor;

.2 Accept assignment of subcontracts pursuant to Section 5.4; and

.3 Finish the Work by whatever reasonable method the Owner may deem expedient. Upon written request of the Contractor, the Owner shall furnish to the Contractor a detailed accounting of the costs incurred by the Owner in finishing the Work.

§ 14.2.3 When the Owner terminates the Contract for one of the reasons stated in Section 14.2.1, the Contractor shall not be entitled to receive further payment until the Work is finished.

§ 14.2.4 If the unpaid balance of the Contract Sum exceeds costs of finishing the Work, including compensation for the Design Agent's services and expenses made necessary thereby, and other damages incurred by the Owner and not expressly waived, such excess shall be paid to the Contractor. If such costs and damages exceed the unpaid balance, the Contractor shall pay the difference to the Owner. The amount to be paid to the Contractor or Owner, as the case may be, shall be certified by the Initial Decision Maker, upon application, and this obligation for payment shall survive termination of the Contract.

§ 14.3 SUSPENSION BY THE OWNER FOR CONVENIENCE

§ 14.3.1 The Owner may, without cause, order the Contractor in writing to suspend, delay or interrupt the Work in whole or in part for such period of time as the Owner may determine.

§ 14.3.2 The
(Paragraphs deleted)
Owner shall not be liable to the Contractor or any Subcontractor for claims or damages of any nature caused by or arising out of any delays. The sole remedy against the Owner for delays shall be the allowance of additional time for completion of the Work in accordance with the provisions of Section 8.3.1.

§ 14.4 TERMINATION BY THE OWNER FOR CONVENIENCE

§ 14.4.1 The Owner may, at any time, terminate the Contract for the Owner's convenience and without cause.

§ 14.4.2 Upon receipt of written notice from the Owner of such termination for the Owner's convenience, the Contractor shall:

.1 cease operations as directed by the Owner in the notice;

.2 take actions necessary, or that the Owner may direct, for the protection and preservation of the Work; and

.3 except for Work directed to be performed prior to the effective date of termination stated in the notice, terminate all existing subcontracts and purchase orders and enter into no further subcontracts and purchase orders.

§ 14.4.3 In case of such termination for the Owner's convenience, the Contractor shall be entitled to receive payment for Work executed, and costs incurred by reason of such termination.

ARTICLE 15 CLAIMS AND DISPUTES

§ 15.1 CLAIMS

§ 15.1.1 DEFINITION

A Claim is a demand or assertion by one of the parties seeking, as a matter of right, payment of money, or other relief with respect to the terms of the Contract. The term "Claim" also includes other disputes and matters in question between the Owner and Contractor arising out of or relating to the Contract. The responsibility to substantiate Claims shall rest with the party making the Claim.

§ 15.1.2 NOTICE OF CLAIMS

Claims by either the Owner or Contractor must be initiated by written notice to the other party. Such notice shall be provided in writing to the designated representative of the party to whom the notice is addressed and shall be deemed to have been duly serviced if delivered in person, by mail, by courier, or by electronic transmission. Claims by either party must be initiated within 21 working days after occurrence of the event giving rise to such Claim or within 21 working days after the claimant first recognizes the condition giving rise to the Claim, whichever is later.

§ 15.1.3 CONTINUING CONTRACT PERFORMANCE

Pending final resolution of a Claim, except as otherwise agreed in writing or as provided in Section 9.7 and Article 14, the Contractor shall proceed diligently with performance of the Contract and the Owner shall continue to make payments in accordance with the Contract Documents. The Design Agent will prepare Change Orders and issue Certificates for Payment in accordance with the decisions of the Initial Decision Maker.

§ 15.1.4 CLAIMS FOR ADDITIONAL COST

If the Contractor wishes to make a Claim for an increase in the Contract Sum, written notice as provided herein shall be given before proceeding to execute the Work. Prior notice is not required for Claims relating to an emergency endangering life or property arising under Section 10.4.

§ 15.1.5 CLAIMS FOR ADDITIONAL TIME

§ 15.1.5.1 If the Contractor wishes to make a Claim for an increase in the Contract Time, written notice as provided herein shall be given. The Contractor's Claim shall include an estimate of cost and of probable effect of delay on progress of the Work. In the case of a continuing delay, only one Claim is necessary.

§ 15.1.5.2 If adverse weather conditions are the basis for a Claim for additional time, such Claim shall be documented by data substantiating that weather conditions were abnormal for the period of time, could not have been reasonably anticipated and had an adverse effect on the scheduled construction.

§ 15.1.5.3 Claims for increase in the Contract Time shall set forth in detail the circumstances that form the basis for the Claim, the date upon which each cause of delay began to affect the progress of the Work, the date upon which each cause of delay ceased to affect the progress of the Work and the number of days' increase in the Contract Time claimed as a consequence of each such cause of delay. The Contractor shall provide such supporting documentation as the Owner may require including, where appropriate, a revised construction schedule indicating all the activities affected by the circumstances forming the basis of the Claim.

§ 15.1.5.4 The Contractor shall not be entitled to a separate increase in the Contract Time for each one of the number of causes of delay which may have concurrent or interrelated effects on the progress of the Work, or for concurrent delays due to the fault of the Contractor.

§ 15.1.6
(Paragraphs deleted)
Deleted.

§ 15.2 INITIAL DECISION
§ 15.2.1 Claims shall be referred to the Initial Decision Maker for initial decision. The University of Rhode Island Vice President for Administration and Finance appointed pursuant to the provisions of the "Delegation of Limited Procurement Authority," dated January 19, 2018, will serve as the Initial Decision Maker in accordance with the provisions of the "Delegations of Limited Procurement Authority," State Purchases Act, State of Rhode Island Procurement Regulations, and this Section 15.2.1. An initial decision shall be required as a condition precedent to binding dispute resolution pursuant to Section 15.3.1 of any Claim arising prior to the date final payment is due.

§ 15.2.2 Deleted.

§ 15.2.3 Deleted.

§ 15.2.4 Deleted.

§ 15.2.5 Deleted.

§ 15.2.6 Deleted.

§ 15.2.6.1 Deleted.

§ 15.2.7 Deleted.

§ 15.2.8 Deleted.

§ 15.3 MEDIATION
§ 15.3.1 For any Claim not resolved by the Initial Decision Maker procedures set forth in Section 15.2.1, and prior to the implementation of the binding dispute resolution procedures set forth in Section 15.4.1, the Contractor or the Architect shall have the option to pursue mediation, exercisable by written notice to the Owner within 30 calendar days of an Initial Decision. In the event of the exercise of such option by the Contractor or the Architect, the Owner and the Contractor or the Architect shall attempt to select a mediator, and in the event that the Owner and the Contractor or the Architect cannot agree on a mediator, either party may apply in writing to the Presiding Justice of the Providence County Superior Court, with a copy to the other, with a request for the court to appoint a mediator, and the costs of the mediator shall be borne equally by both parties.

§ 15.3.2 Deleted.

§ 15.3.3 Deleted.

§ 15.4 BINDING DISPUTE RESOLUTION
§ 15.4.1 For any Claim not resolved by the Initial Decision Maker procedures set forth in Section 15.2.1, or mediation at the option of the Contractor pursuant to Section 15.3.1, the method of binding dispute resolution shall be determined in accordance with the provisions of the "Public Works Arbitration Act," R.I. Gen. Laws §§ 37-16-1 et seq.

(Paragraphs deleted)

§ 15.4.4 Deleted.

§ 15.4.4.1 Deleted.

§ 15.4.4.2 Deleted.

§ 15.4.4.3 Deleted.

§ 16 COMPLIANCE WITH APPLICABLE LAW

The Contractor and its Subcontractors shall comply with all applicable federal, state, and local laws.

DOCUMENT 00 7200 – URI STANDARD DOCUMENTS

PART 1 – GENERAL

1.1 The latest version of the following documents, available on the URI Capital Projects website, http://web.uri.edu/capitalprojects/manual-for-construction-project-safety-procedures/, will apply to all of the work of this project and are hereby incorporated by reference:

URI Sexual Harassment Policy
Manual for Construction Project Safety Procedures
Hot Work Procedure
Managing Fire Protection System Impairment
URI Water System Regulations/Policies

END OF DOCUMENT

SECTION 01 1000 - SUMMARY

PART 1 - GENERAL

1.01 PROJECT

A. See Bid Form for official Project Information.

B. The Project consists of the construction of the following types of work:
   1. Interior renovation of existing office suite including: new reception area, additional offices, kitchenette and conference room. Provide power outlets on new partitions, new recessed can lights, relocate 2x4 fixtures, smoke and sprinkler modifications. Office rearrangement requires fan coil relocation with 2 new ones sized for the individual offices.
   2. Abatement of asbestos as described in the abatement plan, Attachment C, at the end of this section.

1.02 CONTRACT DESCRIPTION

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

1.03 DESCRIPTION OF WORK

A. Scope of demolition and removal work is shown on drawings plus as specified in Section 02 4100.

B. Scope of alterations work is shown on drawings and/or as specified herein.

C. Site modifications: None.

D. Architectural modifications: Interior improvements to Dean’s Suite and Student Services located on the Second Floor of Chafee Hall.

E. Mechanical: Relocate 2 fan coil units and add 2 new ones.

F. Electrical: Added outlets and panelboard for new offices. Relocated light fixtures and new recessed can spotlights. Minimal Fire alarm and sprinkler modifications.

1.04 OWNER OCCUPANCY/SCHEDULE

A. Owner intends to continuously occupy the facility. Work areas will be made available as mutually agreed to during project scheduling. See Attachment A at the end of this section for availability and restrictions on access to spaces.

B. Work to begin within 7 days of receipt of Purchase Order unless otherwise defined in Attachment A at the end of this section.

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

1.05 CONTRACTOR USE OF SITE AND PREMISES

A. Construction Operations: Limited to areas noted on Drawings. Coordinate with Attachment A following this section. Include all costs of this coordination, including all

premium time wages that may be required to meet these requirements, in the Base bid.

B. Arrange use of site and premises to allow:
   1. Adjacent projects to progress as planned for the Owner.
   2. Use of street and adjacent properties by the Public.
   3. Continued operation of the facility in accordance with Attachment A.

C. Provide access to and from site as required by law and by Owner:
   1. Maintain appropriate egress for workforce and users of the facility.
   2. Do not obstruct roadways, sidewalks, or other public ways without permit. Provide necessary signage and barriers to direct pedestrians around work areas.

D. Time Restrictions:
   1. Limit conduct of especially noisy work when events are in process.
   2. Night and weekend work is not allowed.
   3. Refer to Attachment A following this section for building specific scheduling restrictions

E. Utility Outages and Shutdown:
   1. Do not disrupt or shut down life safety systems, including but not limited to fire sprinklers and fire alarm system, without 7 days notice to Owner and authorities having jurisdiction.
   2. Prevent accidental disruption of utility services to other facilities.
   3. Contractor to provide written notification on Fire Sprinkler and Alarm System Impairment Notification Form following this section as Attachment B.

1.06 ITEMS TO BE SALVAGED

A. Existing finishes, furniture and equipment are to remain throughout the suite unless specifically noted to be demolished.

B. Lighting indicated to remain is to be salvaged, stored and reinstalled.

C. Confirm with Owner prior to the removal of any furniture or equipment.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION – NOT USED

END OF MAIN SECTION – See Attachments A, B, and C following.

01 1030 SUMMARY - Attachment A:

NOTE:
Unrestricted = Contractor to plan and schedule work and submit for review by Owner
Limited Restriction = Contractor to meet with Owner and coordinate access to these areas
Restricted = Contractor is not to perform work in these areas.

BASEMENT:

Contractor will have to coordinate work with Owner to maintain Owner access to the Mechanical and Electrical Rooms. Elevator use is not permitted.

FIRST FLOOR:

Contractor will have to coordinate work with Owner to access HVAC piping. Material and staff entering the suite can be through the South stair tower.

SECOND FLOOR:

Dean's Suite and Student Affairs - Work must be done in May through August 2019. These areas will be closed to URI and the public during this time frame.
Work on the second Floor must be completer and able to be occupied by September 1st.

All other areas are limited restriction.

SITE:

Setup and storage boxes may be located on the south side near Rodman Hall. Any disturbed areas must be returned to original condition after construction to the satisfaction of the University Landscape Architect.

OTHER AREAS/GENERAL NOTES:

There shall be no abatement activities and no work in public spaces before May13.

Coordinate daily activities and barricades to segregate people from construction activities.

This is an occupied building. As such, all work must be performed in areas that are not occupied.

The Contractor will be responsible for providing protection for all furniture and belongings in each office of the Dean's Suite. This can be accomplished by sealing the office doors where no work is called for with polyethelene sheets.

The Contractor is responsible for maintaining egress paths during construction to the satisfaction of the Fire Marshall and the AHJ.

The building occupants are sensitive to dust issues. The Contractor will be responsible for providing dust containment in each area while it is under construction and then cleaning each contained area daily when the shift is over. The Contractor will also be responsible for providing and maintaining temporary construction filters on all return air grills and AHUs and replacing with new filters at substantial completion.

Contractor is responsible for coordinating with the Owner for exterior hoisting, if needed, with respect to timing, crane placement, window removal, temporary openings and restoration, etc, and is responsible for any and all associated costs.

Parking is restricted to areas designated by the University.

END OF ATTACHMENT

THE UNIVERSITY OF RHODE ISLAND
DIVISION OF ADMINISTRATION AND FINANCE
THINK BIG WE DO
OFFICE OF CAPITAL PROJECTS
Sherman Building, 523 Plains Road, Kingston, RI 02881 USA p: 401.874.2725 f: 401.874.5599

Fire Sprinkler and Alarm System Impairment Notification Form

To: URI Office of Capital Projects

Date _____

Start of Planned Impairment: _____
End of Planned Impairment: _____
Building occupied during impairment: Yes:_____ No:_____
Any hot work to be performed: Yes:_____ No:_____

Description of Work to be performed: _____

URI Manager of Alarms, Mike Suriani, can also be directly contacted at 401-639-2268.

Contractor supervisory personnel shall remain in the building for the entire duration of the impairment.

Name:_____

Company:_____

Phone:_____

01 1030 SUMMARY - Attachment C:
Abatement Plan

The asbestos abatement plan following this page has been prepared by the University's consultant and applies to the work areas of this project as noted. The following work has already been accomplished by other subcontractors:

None.

The following work is to be included as part of this project and shall be included in the Base Bid price:

Refer to enclosed report from ECM.

END OF ATTACHMENT

ECM Environmental
Consulting & Management

June 15, 2018

University of Rhode Island
Attn: Ms. Abigail Bernier
177 Plains Road
Kingston, RI 02881

Re: Chafee Hall: Rooms 204, 205, Corridor 252 – Asbestos Bulk Sampling Results

Ms. Bernier:

Enclosed are the asbestos bulk sample results collected by Environmental Consulting and Management (ECM) from Rooms 204, 205 and Corridor 252 of Chafee Hall located at 142 Flagg Road, University of Rhode Island, Kingston Campus. Sampling was conducted of suspect asbestos containing building materials (ACBM) that will be impacted during upcoming renovations.

Asbestos Report:

The inspection consisted of identifying and collecting suspect building materials from the proposed areas. These materials are then analyzed for asbestos content utilizing Polarized Light Microscopy (PLM) in accordance with Environmental Protection Agency (EPA) method 600/R-93/116. In addition to collection, location of ACBM has also been denoted within this report. Please refer to **Attachment 1** for the analytical results and **Attachment 2** for building drawings. Below is a chart of the samples provided.

Chafee Hall – Asbestos Bulk Sample Results ID# 18020141

Sample #	Material	Location	Asbestos %	Quantity
01A	Spray-on Fireproofing	Room 204	None Detected	–
02A	2x2 Ceiling Tile	Room 204, Corridor 252	None Detected	–
03A	12x12 Beige Floor Tile	Room 204 – On Floating Floor	None Detected	–
04A	Brown Mastic to 03A		None Detected	–
05A	Stanchion Adhesive	Room 204 – Under Floating Floor on concrete	None Detected	–
06A	Sheetrock	Room 204 – Wall to be removed	None Detected	–
07A	Joint Compound		Negative (<1% Chrysotile)	–
08A	12x12 Brown Floor Tile	Room 204 – Under Ramp	None Detected	–
09A	Black Mastic to 08A		None Detected	–

181 Amaral Street
Riverside, RI 02915

O: 401.438.1360
F: 401.438.1316

www.ecmne.com

Chafee Hall – Asbestos Bulk Sample Results ID# 18020141 Continued

Sample #	Material	Location	Asbestos %	Quantity
010A	Cove Base	Room 204, 205, Corridor 252	None Detected	--
011A	Cove Base Adhesive		None Detected	–
012A	12x12 Black Floor Tile	Room 205	None Detected	–
013A	Yellow Mastic to 012A		None Detected	–
014A	Tectam Panel		None Detected	--

Chafee Hall – Asbestos Bulk Sample Results ID# 180223911

Sample #	Material	Location	Asbestos %	Quantity
01A	**12x12 Chocolate Brown Floor Tile**	**Corridor 252**	**3% Chrysotile**	**~200 sf**
02A	Black Mastic to 01A	Corridor 252	None Detected	–

Asbestos Conclusion:

The 12x12 chocolate brown floor tile in Corridor 252 was found to be positive for the presence of asbestos.

If the University is to remove the asbestos containing materials, an asbestos abatement plan will need to be created and submitted to the Rhode Island Department of Health (RIDOH) as the quantity of materials is greater than 25 square feet/10 linear feet. Removal will need to be conducted by a RI licensed asbestos abatement contractor.

After the abatement plan is submitted to the RIDOH, the approval process takes approximately 2 to 3 weeks. Once the abatement plan is approved, a letter will be sent out to the building owner with an identification number designated to the project. The approval number is then utilized by the abatement contractor to submit the 10-day notification to the RIDOH, where activities cannot begin until 10 calendar days after the notification is submitted.

The joint compound sample that was found to be 2% Chrysotile asbestos was re-analyzed utilizing the point counting 400 method. The sample was found to be less than 1% Chrysotile asbestos and can be considered negative by EPA and RIDOH regulations. However, the Occupational Health and Safety Administration (OSHA) recommends that personal protective equipment be worn and wet methods be utilized when dealing with materials containing less than 1% asbestos. The results can be found in Attachment 1 on analysis report ID# 18021772.

Any suspect materials not identified within this report should be sampled prior to being impacted.

Limitations:

As the survey was limited, Environmental Consulting and Management cannot be held responsible for the identification of materials that are hidden, concealed or otherwise inaccessible.

This report was prepared under the request of University of Rhode Island. This report should not be represented, reproduced, or disseminated without the written approval of Environmental Consulting and Management or University of Rhode Island. No warranties other than those expressed in the contract for this project are expressed or implied.

A hard copy of this report can be provided for your records via mail upon request. If you have any further questions feel free to contact myself at 401-301-8494.

Sincerely,
Environmental Consulting & Management

Charles E. Prescott III
Project Manager
RI Asbestos Insp. Lic. #AAC-0642

181 Amaral Street
Riverside, RI 02915

O: 401.438.1360
F: 401.438.1316

www.ecmne.com

ECM Environmental
Consulting & Management

Attachment 1
Asbestos Bulk Sample Results

181 Amaral Street
Riverside, RI 02915

O: 401.438.1360
F: 401.438.1316

www.ecmne.com

SanAir Technologies Laboratory

The Identification Specialists

Analysis Report
prepared for
Environmental Consulting & Management Inc

Report Date: 5/22/2018

Project Name: URI Chafee

Project #: 180389

SanAir ID#: 18020141

NVLAP TESTING

NVLAP LAB CODE 200870-0

1551 Oakbridge Dr. Suite B | Powhatan, Virginia 23139-8061
888.895.1177 | 804.897.1177 | fax: 804.897.0070 | IAQ@SanAir.com | SanAir.com

SanAir
Technologies Laboratory

SanAir ID Number
18020141
FINAL REPORT
5/22/2018 8:02:18 PM

Name: Environmental Consulting & Management Inc
Address: 50 Kickemuit Ave
Bristol, RI 02809
Phone: 401-438-1360

Project Number: 180389
P.O. Number:
Project Name: URI Chafee
Collected Date: 5/14/2018
Received Date: 5/15/2018 10:05:00 AM

Dear Chad Prescott,

We at SanAir would like to thank you for the work you recently submitted. The 14 sample(s) were received on Tuesday, May 15, 2018 via FedEx. The final report(s) is enclosed for the following sample(s): 01A, 02A, 03A, 04A, 05A, 06A, 07A, 08A, 09A, 010A, 011A, 012A, 013A, 014A.

These results only pertain to this job and should not be used in the interpretation of any other job. This report is only complete in its entirety. Refer to the listing below of the pages included in a complete final report.

Sincerely,

Sandra Sobrino

Sandra Sobrino
Asbestos & Materials Laboratory Manager
SanAir Technologies Laboratory

Final Report Includes:
- Cover Letter
- Analysis Pages
- Disclaimers and Additional Information

Sample conditions:
- 14 samples in Good condition.

SanAir Technologies Laboratory

SanAir ID Number
18020141
FINAL REPORT
5/22/2018 8:02:18 PM

Name: Environmental Consulting & Management Inc
Address: 50 Kickemuit Ave
Bristol, RI 02809
Phone: 401-438-1360

Project Number: 180389
P.O. Number:
Project Name: URI Chafee
Collected Date: 5/14/2018
Received Date: 5/15/2018 10:05:00 AM

Analyst: Sobrino, Sandra | Steiner, Tara

Asbestos Bulk PLM EPA 600/R-93/116

	Stereoscopic	Components		
SanAir ID / Description	Appearance	% Fibrous	% Non Fiberous	Asbestos Fibers
01A / 18020141-001 Spray-On Fire Proofing	Off-White Non-Fibrous Homogeneous	15% Cellulose	85% Other	None Detected
02A / 18020141-002 2X2 Ceiling Tile	White Fibrous Homogeneous	65% Cellulose	35% Other	None Detected
03A / 18020141-003 12X12 Floor Tile	Beige Non-Fibrous Homogeneous		100% Other	None Detected
04A / 18020141-004 Mastic	Brown Non-Fibrous Homogeneous		100% Other	None Detected
05A / 18020141-005 Stanchion Adhesive	Black Non-Fibrous Homogeneous		100% Other	None Detected
06A / 18020141-006 Sheetrock	White Non-Fibrous Homogeneous	5% Cellulose	95% Other	None Detected
07A / 18020141-007 Joint Compound	White Non-Fibrous Homogeneous		98% Other	2% Chrysotile
08A / 18020141-008 12X12 Floor Tile	Brown Non-Fibrous Homogeneous		100% Other	None Detected
09A / 18020141-009 Mastic	Black Non-Fibrous Homogeneous	5% Cellulose	95% Other	None Detected
010A / 18020141-010 Cove Base	Blue Non-Fibrous Homogeneous		100% Other	None Detected

Analyst: Sandra Sobrino Approved Signatory:

Analysis Date: 5/22/2018 Date: 5/22/2018

SanAir Technologies Laboratory

SanAir ID Number
18020141
FINAL REPORT
5/22/2018 8:02:18 PM

Name: Environmental Consulting & Management Inc
Address: 50 Kickemuit Ave
Bristol, RI 02809
Phone: 401-438-1360

Project Number: 180389
P.O. Number:
Project Name: URI Chafee
Collected Date: 5/14/2018
Received Date: 5/15/2018 10:05:00 AM

Analyst: Sobrino, Sandra | Steiner, Tara

Asbestos Bulk PLM EPA 600/R-93/116

	Stereoscopic	Components		
SanAir ID / Description	Appearance	% Fibrous	% Non Fiberous	Asbestos Fibers
011A / 18020141-011 Cove Base Adhesive	Yellow Non-Fibrous Homogeneous		100% Other	None Detected
012A / 18020141-012 12X12 Floor Tile	Black Non-Fibrous Homogeneous		100% Other	None Detected
013A / 18020141-013 Mastic	Yellow Non-Fibrous Homogeneous	< 1% Cellulose	100% Other	None Detected
014A / 18020141-014 Tectam Panel	Tan Non-Fibrous Heterogeneous	5% Cellulose	95% Other	None Detected

Analyst: Sandra Sobrino
Analysis Date: 5/22/2018

Approved Signatory:
Date: 5/22/2018

SanAir Technologies Laboratory

Analysis Report

prepared for

Environmental Consulting & Management Inc

Report Date: 5/25/2018
Project Name: URI Chafee
Project #: 180389
SanAir ID#: 18021772

NVLAP LAB CODE 200870-0

Virginia SBE Certification # 652931

Texas Licensed Mold Analysis Laboratory License # LAB0166

SanAir Technologies Laboratory

804.897.1177 www.sanair.com

SanAir Technologies Laboratory, Inc.
1551 Oakbridge Drive, Suite B, Powhatan, VA 23139
804.897.1177 Toll Free: 888.895.1177 Fax: 804.897.0070
Web: http://www.sanair.com E-mail: iaq@sanair.com

Environmental Consulting & Management Inc
50 Kickemuit Ave
Bristol, RI 02809

May 25, 2018

SanAir ID # 18021772
Project Name: URI Chafee
Project Number: 180389

Dear Chad Prescott,

We at SanAir would like to thank you for the work you recently submitted. The 1 sample(s) were received on Thursday, May 24, 2018 via Fax or Email request. The final report(s) is enclosed for the following sample(s): 07A.

These results only pertain to this job and should not be used in the interpretation of any other job. This report is only complete in its entirety. Refer to the listing below of the pages included in a complete final report.

Sincerely,

Sandra Sobrino

Sandra Sobrino
Asbestos & Materials Laboratory Manager
SanAir Technologies Laboratory

Final Report Includes:
- Cover Letter
- Analysis Pages
- Disclaimers and Additional Information

sample conditions:
1 sample(s) in Good condition

SanAir Technologies Laboratory, Inc.
1551 Oakbridge Drive, Suite B, Powhatan, VA 23139
804.897.1177 Toll Free: 888.895.1177 Fax: 804.897.0070
Web: http://www.sanair.com E-mail: iaq@sanair.com

SanAir ID Number
18021772
FINAL REPORT

Name: Environmental Consulting & Management Inc
Address: 50 Kickemuit Ave
Bristol, RI 02809

Project Number: 180389
P.O. Number:
Project Name: URI Chafee

Collected Date: 5/14/2018
Received Date: 5/24/2018 11:08:00 AM
Report Date: 5/25/2018 2:34:22 PM
Analyst: Sobrino, Sandra

Asbestos Bulk EPA PLM 400 Point Count

SanAir ID / Description	Stereoscopic Appearance	Components % Fibrous	% Non-Fibrous	Asbestos Fibers
07A / 18021772-001 Joint Compound	White Non-Fibrous Homogeneous		99.25% Other	0.75% Chrysotile

Certification

Analyst: Sandra Sobrino
Analysis Date: 5/25/2018

Approved Signatory: Erin Robertson
Date: 5/25/2018

Disclaimer

The final report cannot be reproduced, except in full, without written authorization from SanAir. Fibers smaller than 5 microns cannot be seen with this method due to scope limitations. The accuracy of the results is dependent upon the client's sampling procedure and information provided to the laboratory by the client. SanAir assumes no responsibility for the sampling procedure and will provide evaluation reports based solely on the sample and information provided by the client. This report may not be used by the client to claim product endorsement by NVLAP, AIHA or any other agency of the U.S. government*; and may not be certified by every local, state and federal regulatory agencies.*

SanAir Technologies Laboratory

The Identification Specialists

Analysis Report
prepared for
Environmental Consulting & Management Inc

Report Date: 6/14/2018

Project Name: URI Chafee Hall

Project #: 180389

SanAir ID#: 18023911

NVLAP TESTING

NVLAP LAB CODE 200870-0

1551 Oakbridge Dr. Suite B | Powhatan, Virginia 23139-8061
888.895.1177 | 804.897.1177 | fax: 804.897.0070 | IAQ@SanAir.com | SanAir.com

SanAir
Technologies Laboratory

SanAir ID Number
18023911
FINAL REPORT
6/14/2018 3:50:20 PM

Name: Environmental Consulting & Management Inc
Address: 50 Kickemuit Ave
Bristol, RI 02809
Phone: 401-438-1360

Project Number: 180389
P.O. Number:
Project Name: URI Chafee Hall
Collected Date: 6/5/2018
Received Date: 6/7/2018 10:40:00 AM

Dear Chad Prescott,

We at SanAir would like to thank you for the work you recently submitted. The 2 sample(s) were received on Thursday, June 07, 2018 via FedEx. The final report(s) is enclosed for the following sample(s): 01A, 02A.

These results only pertain to this job and should not be used in the interpretation of any other job. This report is only complete in its entirety. Refer to the listing below of the pages included in a complete final report.

Sincerely,

Sandra Sobrino

Sandra Sobrino
Asbestos & Materials Laboratory Manager
SanAir Technologies Laboratory

Final Report Includes:
- Cover Letter
- Analysis Pages
- Disclaimers and Additional Information

Sample conditions:
- 2 samples in Good condition.

SanAir Technologies Laboratory

SanAir ID Number
18023911
FINAL REPORT
6/14/2018 3:50:20 PM

Name: Environmental Consulting & Management Inc
Address: 50 Kickemuit Ave
Bristol, RI 02809
Phone: 401-438-1360

Project Number: 180389
P.O. Number:
Project Name: URI Chafee Hall
Collected Date: 6/5/2018
Received Date: 6/7/2018 10:40:00 AM

Analyst: Robertson, Erin

Asbestos Bulk PLM EPA 600/R-93/116

	Stereoscopic	Components		
SanAir ID / Description	Appearance	% Fibrous	% Non-fibrous	Asbestos Fibers
01A / 18023911-001 12X12 FT/ Corridor 252	Brown Non-Fibrous Homogeneous		97% Other	3% Chrysotile
02A / 18023911-002 Mastic/ Corridor 252	Black Non-Fibrous Homogeneous		100% Other	None Detected

Analyst: Erin Robertson
Approved Signatory:

Analysis Date: 6/14/2018
Date: 6/14/2018

Disclaimer

The final report cannot be reproduced, except in full, without written authorization from SanAir. Fibers smaller than 5 microns cannot be seen with this method due to scope limitations. The accuracy of the results is dependent upon the client's sampling procedure and information provided to the laboratory by the client. SanAir assumes no responsibility for the sampling procedure and will provide evaluation reports based solely on the sample and information provided by the client. This report may not be used by the client to claim product endorsement by NVLAP or any other agency of the U.S. government. Samples are held for a period of 60 days.

For NY state samples, method EPA 600/M4-82-020 is performed.

Polarized- light microscopy is not consistently reliable in detecting asbestos in floor covering and similar non-friable organically bound materials. Quantitative transmission electron microscopy is currently the only method that can be used to determine if this material can be considered or treated as non-asbestos containing.

Asbestos Certifications
NVLAP lab code 200870
City of Philadelphia: ALL-460
PA Department of Environmental Protection Number: 68-05397
California License Number: 2915
Colorado License Number: AL-23143
Connecticut License Number: PH-0105
Massachusetts License Number: AA000222
Maine License Number: LB-0075
New York ELAP lab ID: 11983
Rhode Island License Number: AAL-126
Texas Department of State Health Services License Number: 300440
Commonwealth of Virginia 3333000323
Washington State License Number: C989
West Virginia License Number: LT000566
Vermont License: AL166318

Revision Date: 11/30/2017

ECM Environmental Consulting & Management

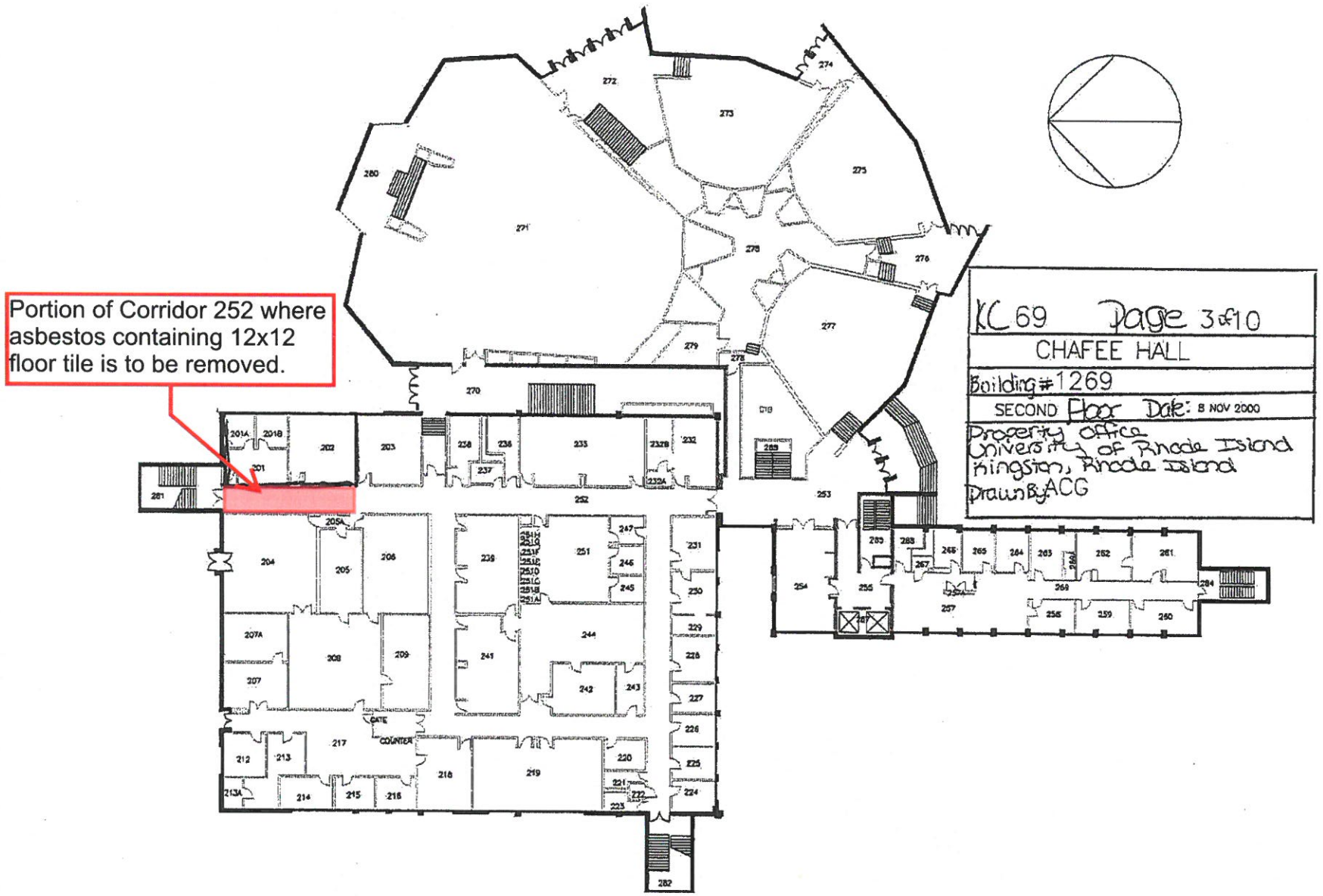
Attachment 2
Building Drawings

181 Amaral Street
Riverside, RI 02915

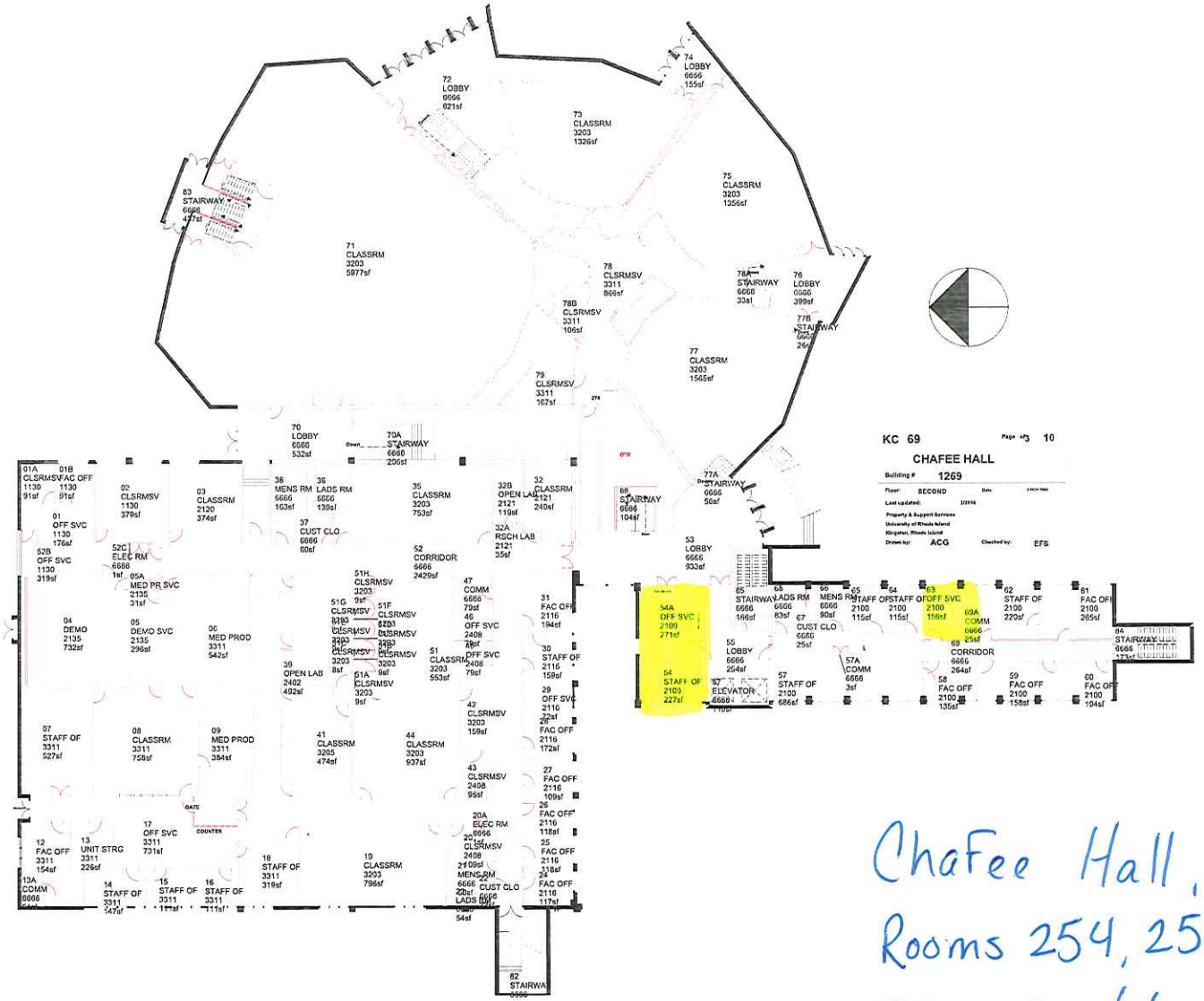
O: 401.438.1360
F: 401.438.1316

www.ecmne.com

INSITE Visual-FM 2.52



DRAWING: Kc69-2.ins SCALE: 1" = 40.8' PLOTTED: 04/09/04



Chafee Hall, second floor
Rooms 254, 254A, 263
approximately 654 sf

SanAir Technologies Laboratory

Analysis Report

prepared for

Environmental Consulting & Management Inc

Report Date: 8/21/2017
Project Name: URI Chafee Hall 201
Project #: 170526
SanAir ID#: 17031412

NVLAP LAB CODE 200870-0

Virginia SBE Certification # 652931

Texas Licensed Mold Analysis Laboratory License # LAB0166

SanAir Technologies Laboratory

804.897.1177 www.sanair.com

SanAir Technologies Laboratory, Inc.
1551 Oakbridge Drive, Suite B, Powhatan, VA 23139
804.897.1177 Toll Free: 888.895.1177 Fax: 804.897.0070
Web: http://www.sanair.com E-mail: iaq@sanair.com

Environmental Consulting & Management Inc
50 Kickemuit Ave
Bristol, RI 02809

August 21, 2017

SanAir ID # 17031412
Project Name: URI Chafee Hall 201
Project Number: 170526

Dear Chad Prescott,

We at SanAir would like to thank you for the work you recently submitted. The 2 sample(s) were received on Monday, August 14, 2017 via FedEx. The final report(s) is enclosed for the following sample(s): 01, 02.

These results only pertain to this job and should not be used in the interpretation of any other job. This report is only complete in its entirety. Refer to the listing below of the pages included in a complete final report.

Sincerely,

Sandra Sobrino

Sandra Sobrino
Asbestos & Materials Laboratory Manager
SanAir Technologies Laboratory

Final Report Includes:
- Cover Letter
- Analysis Pages
- Disclaimers and Additional Information

sample conditions:
2 sample(s) in Good condition

SanAir Technologies Laboratory, Inc.

1551 Oakbridge Drive, Suite B, Powhatan, VA 23139
804.897.1177 Toll Free: 888.895.1177 Fax: 804.897.0070
Web: http://www.sanair.com E-mail: iaq@sanair.com

SanAir ID Number
17031412
FINAL REPORT

Name: Environmental Consulting & Management Inc
Address: 50 Kickemuit Ave
Bristol, RI 02809

Project Number: 170526
P.O. Number:
Project Name: URI Chafee Hall 201

Collected Date: 8/9/2017
Received Date: 8/14/2017 9:25:00 AM
Report Date: 8/21/2017 3:12:32 PM
Analyst: Steiner, Tara

Asbestos Bulk PLM EPA 600/R-93/116

SanAir ID / Description	Stereoscopic Appearance	Components % Fibrous	% Non-Fibrous	Asbestos Fibers
01 / 17031412-001 Floor Tile	Brown Non-Fibrous Homogeneous		97% Other	3% Chrysotile

SanAir ID / Description	Stereoscopic Appearance	Components % Fibrous	% Non-Fibrous	Asbestos Fibers
02 / 17031412-002 Mastic	Black Non-Fibrous Heterogeneous		100% Other	None Detected

Certification

Analyst: Tara C. Steiner
Analysis Date: 8/21/2017

Approved Signatory:
Date: 8/21/2017

Disclaimer

The final report cannot be reproduced, except in full, without written authorization from SanAir. Fibers smaller than 5 microns cannot be seen with this method due to scope limitations. The accuracy of the results is dependent upon the client's sampling procedure and information provided to the laboratory by the client. SanAir assumes no responsibility for the sampling procedure and will provide evaluation reports based solely on the sample and information provided by the client. This report may not be used by the client to claim product endorsement by NVLAP or any other agency of the U.S. government.

For NY state samples, method EPA 600/M4-82-020 is performed.

Polarized- light microscopy is not consistently reliable in detecting asbestos in floor covering and similar non-friable organically bound materials. Quantitative transmission electron microscopy is currently the only method that can be used to determine if this material can be considered or treated as non-asbestos containing.

NY ELAP lab ID 11983

SECTION 01 2000 - PRICE AND PAYMENT PROCEDURES

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Allowances.

B. Testing and inspection allowances.

C. Schedule of values.

D. Applications for payment.

E. Warranty inspection retainage.

F. Sales tax exemption.

G. Change procedures.

H. Defect assessment.

I. Unit prices.

J. Alternates.

1.02 ALLOWANCES

A. See General Conditions Article 3.8 for Allowance provisions.

B. Design Agent Responsibility:
   1. Consult with Contractor for consideration and selection of products, suppliers, and Installers.
   2. Select products in consultation with Owner and transmit decision to Contractor.
   3. Prepare Change Order to adjust final cost.

C. Contractor Responsibility:
   1. Assist Design Agent or its Consultants in selection of products, suppliers and installers.
   2. Obtain proposals from suppliers and installers, and offer recommendations.
   3. On notification on selection by Design Agent, execute purchase agreement with designated supplier and installer.
   4. Arrange for and process shop drawings, product data, and samples. Arrange for delivery.
   5. Promptly inspect products upon delivery for completeness, damage, and defects. Submit claims for transportation damage.

D. Schedule of Allowances: See Attachment A.

1.03 TESTING AND INSPECTION ALLOWANCE

A. All costs of regularly scheduled testing are included in the Base Bid. See Attachment A for allowance to cover costs of additional testing to be provided when directed by the Owner.

B. See Section 01 4000 and its attachment for testing requirements.

1.04 SCHEDULE OF VALUES

A. Submit Schedule of Values in duplicate, one copyrighted original and one copy.

B. Format: Utilize the Table of Contents of this Project Manual. Identify each line item with number and title of the major specification Section. Identify site mobilization, bonds, insurance and closeout.

C. Include in each line item, the amount of Allowances specified in this Section. For unit cost Allowances, identify quantities taken from Contract Documents multiplied by the unit cost to achieve the total for the item.

D. Include separately for each line item, a direct proportional amount of Contractor's overhead and profit.

E. Revise schedule to list approved Change Orders, with each Application for Payment.

1.05 APPLICATIONS FOR PAYMENT

A. Submit each application on an original AIA Form G702 - Application and Certificate for Payment and AIA G703 - Continuation Sheet, accompanied by three copies.
   1. Prepare a draft version “pencil copy” of each application and distribute via email 5 days prior to due date for review by Design Agent and Owner’s representative.
   2. After making agreed revisions, individually sign and notarize and emboss with notary's official seal, the original and each of the three copies. Deliver to Owner’s representative for further processing and distribution.
   3. Applications not including original copyrighted AIA G702, and G703 Forms, will be rejected, and returned for re-submittal.
   4. Applications not properly signed and notarized will be rejected, and returned for re-submittal.
   5. Applications submitted without the following items described in this section and its attachments will be returned for resubmittal.

B. Content and Format: Utilize Schedule of Values for listing items in Application for Payment.

C. Provide one hard copy and one copy in disc form of the updated construction schedule with each Application for Payment submission, prepared per Section 01 3300.

1. Provide a statement signed by the Contractor's firm principal certifying that there are no unidentified outstanding claims for delay.

D. Include with each monthly Application for Payment, following the first application, Certified Monthly Payroll Records with proper compliance cover sheet for the previous month's pay period. Identify MBE/DBE subcontractors and hours worked in a format acceptable to URI. See Attachment A this section for current State and Federal requirements.

E. Submit with transmittal letter as specified for Submittals in Section 01 3300.

F. Beginning with the second Application for Payment, Contractor's right to payment must be substantiated by documenting, on a copy of the URI Waiver of Lien Form included in Document 00 6140 - Waiver of Lien Form in this Project Manual, that payment monies due, less retainage not exceeding ten percent, have been paid in full to subcontractor and suppliers for work, materials, or rental of equipment billed for under specific line item numbers in the immediately preceding application.

G. Substantiating Data: When the Owner or Design Agent requires additional substantiating information from the review of the “pencil copy”, submit data justifying dollar amounts in question.

H. In addition to the items above, include the following with the Application for Payment :
1. Record Documents as specified in Section 01 7800, for review by the Owner which will be returned to the Contractor.
2. Affidavits attesting to off-site stored products with insurance certificates as requested.
3. Digital Photographs as specified in Section 01 3300. Include on same disc with construction schedule.

I. Payment Period: Submit at monthly intervals unless stipulated otherwise in the Supplemental General Conditions.

1.06 WARRANTY INSPECTION RETAINAGE

A. A percentage of job cost as defined in Attachment A will be retained from Final Payment for a duration of ten months. If, after ten months, all systems including mechanical and electrical, are determined by the Owner to be properly functioning, the Warranty Inspection Retainage will be released.

B. If, after ten months, there are found to be modifications, adjustments, or corrections necessary to be made to address any system or product malfunction, in order to fulfill specified performance or requirements of such systems or products, release of the warranty inspection retainage will be delayed until such malfunctions are rectified.

C. If, after twelve months from the date of Final Completion, all systems have not been fully addressed, the Owner may utilize the Warranty Inspection Retainage to hire others to execute necessary modifications, adjustments, or corrections.

1.07 SALES TAX EXEMPTION

A. Owner is exempt from sales tax on products permanently incorporated in Work of the Project.
   1. Obtain sales tax exemption certificate number from Owner.
   2. Place exemption certificate number on invoice for materials incorporated in the Work of the Project.
   3. Furnish copies of invoices to Owner.
   4. Upon completion of Work, file a notarized statement with Owner that all purchases made under exemption certificate were entitled to be exempt.
   5. Pay legally assessed penalties for improper use of exemption certificate number.

1.08 CHANGE PROCEDURES

A. Submittals: Submit name of the individual authorized to receive change documents, and be responsible for informing others in Contractor's employ or Subcontractors of changes to the Work.

B. The Design Agent will advise of minor changes in the Work not involving an adjustment to Contract Sum or Contract Time by issuing supplemental instructions on AIA Form G710.

C. The Design Agent may issue a Proposal Request which includes a detailed description of a proposed change with supplementary or revised Drawings and specifications, a change in Contract Time for executing the change with a stipulation of any overtime work required, and the period of time during which the requested price will be considered valid. Contractor will prepare and submit an estimate within 15 days.

D. The Contractor may propose changes by submitting a request for change to the Design Agent, describing the proposed change and its full effect on the Work. Include a statement describing the reason for the change, and the effect on the Contract Sum and Contract Time with full documentation, and a statement describing the effect on Work by separate or other Contractors. Document any requested substitutions in accordance with Section 01 6000.

E. Stipulated Sum Change Order: Based on Proposal Request, and Contractor's fixed price quotation, or Contractor's request for a Change Order as approved by Design Agent.

F. Unit Price Change Order: For contract unit prices and quantities, the Change Order will be executed on a fixed unit price basis. For unit costs or quantities of units of work which are not pre-determined, execute the Work under a Construction Change Directive. Changes in the Contract Sum or Contract Time will be computed as specified for a Time and Material Change Order.

G. Construction Change Directive: Design Agent may issue a directive, on AIA Form G713 Construction Change Directive signed by the Owner, instructing the Contractor to proceed with a change in the Work, for subsequent inclusion in a Change Order. Document will describe changes in the Work, and designate method of determining any change in the Contract Sum or Contract Time. Promptly execute the change.

H. Time and Material Change Order: Submit an itemized account and supporting data after completion of the change, including timeslips signed by Owner's representative, within the time limits indicated in the Conditions of the Contract. The Design Agent will determine the change allowable in the Contract Sum and Contract Time as provided in the Contract Documents. Only Owner-representative-signed timeslips will be considered.

I. Maintain detailed records of work done on a Time and Material basis. Submit timeslips daily for verification and sign-off by Owner's representative on-site. Provide full information required for an evaluation of the proposed changes, and to substantiate costs for the changes in the Work.

J. Document each quotation for a change in cost or time with sufficient data to allow an evaluation of the quotation. Provide detailed breakdown of costs and estimates for labor and materials including a detailed breakdown for subcontractor's or vendor's Work. Include copies of written quotations from subcontractors or vendors.

K. Change Order Forms: AIA G701 Change Order.

L. Execution of Change Orders: The Design Agent will issue Change Orders for signatures of the parties as provided in the Conditions of the Contract.

M. Correlation Of Contractor Submittals:
1. Promptly revise the Schedule of Values and the Application for Payment forms to record each authorized Change Order as a separate line item and adjust the Contract Sum. Promptly revise progress schedules to reflect any change in the Contract Time, revise sub-schedules to adjust times for any other items of work affected by the change, and resubmit.
2. Promptly enter changes in the Project Record Documents.

1.09 DEFECT ASSESSMENT

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

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

C. The defective Work may remain, but the unit sum will be adjusted to a new sum at the discretion of the Design Agent.

D. The defective Work will be partially repaired to the instructions of the Design Agent, and the unit sum will be adjusted to a new sum at the discretion of the Design Agent.

E. The individual Specification Sections may modify these options or may identify a specific formula or percentage sum reduction.

F. The authority of the Design Agent to assess the defect and identify a payment adjustment, is final.

G. Non-Payment for Rejected Products: Payment will not be made for rejected products for any of the following:
1. Products wasted or disposed of in a manner that is not acceptable.
2. Products determined as unacceptable before or after placement.
3. Products not completely unloaded from the transporting vehicle.
4. Products placed beyond the lines and levels of the required Work.
5. Products remaining on hand after completion of the Work.
6. Loading, hauling, and disposing of rejected products.

1.10 UNIT PRICES

A. See Attachment A.

1.11 ALTERNATES

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

B. Coordinate related work and modify surrounding work as required.

C. Schedule of Alternates: See Attachment A.

PART 2 - PRODUCTS

Not Used.

PART 3 - EXECUTION

Not Used.

END OF SECTION

01 2010 PRICE AND PAYMENT PROCEDURES - Attachment A

A. Allowances

1. Include a $10,000 allowance for correction of Unforeseen Architectural Conditions.

B. Testing Allowance

1. None

C. Unit Prices

1. None

D. Alternates

1. Alternate #1 – Delete white vinyl letters on feature walls and provide stainless steel pin letters as specified.
2. Alternate #2 - Add demolition of carpet in Offices 257B, 257C and 262. Provide new CPT-1 in these offices.

E. Payroll Reporting

1. Forms for the submission of Certified Payroll Records may be found from the Rhode Island Prevailing Wage Website in either PDF or Excel formats. These forms must be used on monthly submittals.

2. Identify Apprenticeship hours required under RIGL 37-13-3.1 for all contracts over $1 million in value.

3. A Minority Utilization Report for minority subcontractors must be included. Use the form provided as Attachment B.

E. Warranty Inspection Retainage

1. One-half of one percent of the cost of the Work will be retained from Final Payment for this purpose.

END OF ATTACHMENT

MBE Compliance Office
1 Capitol Hill, 2nd Floor
Providence, RI 02908
401-574-8670, 401-574-8387 (fax)

Attachment B – 01 2020

www.mbe.ri.gov (website)

Pursuant to RIGL 37-14.1 as well as the regulations promulgated thereto, the MBE Compliance Office requires that you complete the following table. Please note that these figures will be verified with the MBEs identified. If there are outstanding issues, such as retainage or a dispute, please indicate and attach supporting documentation for same. Also note that copies of invoice and cancelled checks for payment to all MBE subcontractors and suppliers are required.

Contractor/Vendor Name:
Project Name & Location:
Original Prime Contract Amount: $_____ **Current Prime Contract Amount: _____**

MBE/WBE Subcontractor	Original Contract Amount	Change Orders	Revised Contract Value	% Completed To Date	Amount Paid To Date	Amount Due	Retainage %	Retainage Amount	Explanation

I declare, under penalty of perjury, that the information provided in this verification form and supporting documents is true and correct.

_____ _____
Signature Date

_____
Printed Name

Notary Certificate:

Sworn before me this _____ day of _____ , 2012.

_____ _____
Notary Signature Commission Expires

SECTION 01 3000 - ADMINISTRATIVE REQUIREMENTS

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Site administration

B. Coordination and project conditions.

C. Preconstruction meeting.

D. Site mobilization meeting.

E. Progress meetings.

F. Pre-installation meetings.

1.02 SITE ADMINISTRATION

A. Maintain a daily attendance log to include the names of all project employees and guests to the site. Each guest signing the log should indicate a brief description of the reason for the visit, the guest's employer or organization. The log sheet, or sheets, must clearly indicate the Project Name, and the name of the Prime contractor. Each line in the log should allow for the name of that employee, the employee's job title (use terminology used by prevailing wage job title), and the name of that employee's employer. This log shall be kept on a uniform form prescribed by the Director of Labor and Training. Such log shall be available for inspection on the site at all times by the Purchaser, Owner, and/or the Director of the Department of Labor and Training and his or her designee. Provide copies when requested. The log shall comply with requirements of RIGL 37-12-12(c.).

1.03 COORDINATION AND PROJECT CONDITIONS

A. Coordinate the scheduling, submittals, and the Work of the various Sections of the Project Manual to ensure an efficient and orderly sequence of the installation of interdependent construction elements.

B. Verify that the utility requirements and characteristics of the operating equipment are compatible with the building utilities. Coordinate the Work of the various Sections having interdependent responsibilities for installing, connecting to, and placing in service, such equipment.

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

D. Coordinate the completion and clean up of the Work of the separate Sections in preparation for Substantial Completion and for portions of the Work designated for the Owner's partial occupancy.

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

1.04 PRECONSTRUCTION MEETING

A. The Design Agent will schedule a meeting after a Purchase Order is issued to the Contractor.

B. Attendance Required: Owner's Representative, Design Agent, and Contractor.

C. Agenda:
1. Distribution of the Contract Documents.
2. Submission of a list of Subcontractors, a list of products, schedule of values, and a progress schedule.
3. Designation of the personnel representing the parties in the Contract and the Design Agent.
4. The procedures and processing of the field decisions, submittals, substitutions, applications for payments, proposal requests, Change Orders, and Contract closeout procedures.
5. Scheduling.

D. Contractor shall record the minutes and distribute copies within two days after the meeting to the participants, with copies to the Design Agent, Owner, other participants, and those consultants affected by the decisions made.

1.05 SITE MOBILIZATION MEETING

A. The Design Agent will schedule a meeting at the Project site prior to the Contractor's occupancy and may occur at the same time as the Preconstruction meeting noted above.

B. Attendance Required: The Owner, Design Agent, Contractor, the Contractor's Superintendent, and major Subcontractors.

C. Agenda:
1. Use of the premises by the Owner and the Contractor.
2. The Owner's requirements and partial occupancy.
3. Construction facilities and controls provided by the Owner.
4. Temporary utilities provided by the Owner.
5. Security and housekeeping procedures.
6. Schedules.
7. Application for payment procedures.
8. Procedures for testing.

9. Procedures for maintaining the record documents.
10. Requirements for the start-up of equipment.
11. Inspection and acceptance of the equipment put into service during the construction period.

D. Contractor shall record the minutes and distribute the copies within two days after the meeting to the participants, with copies to the Design Agent, Owner, other participants, and those consultants affected by the decisions made.

1.06 PROGRESS MEETINGS

A. Schedule and administer the meetings throughout the progress of the Work at weekly intervals while work is in process.

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

C. Attendance Required: The job superintendent, major subcontractors and suppliers, the Owner, Design Agent, and Consultants as appropriate to agenda topics for each meeting.

D. Agenda:
1. Review the minutes of previous meetings.
2. Review of the Work progress.
3. Field observations, problems, and decisions.
4. Identification of the problems which impede the planned progress.
5. Review of the submittals schedule and status of the submittals.
6. Review of delivery schedules.
7. Maintenance of the progress schedule.
8. Corrective measures to regain the projected schedules.
9. Planned progress during the succeeding work period.
10. Coordination of the projected progress.
11. Maintenance of the quality and work standards.
12. Effect of the proposed changes on the progress schedule and coordination.
13. Other business relating to the Work.

E. Contractor shall record the minutes and distribute the copies within two days after the meeting to the participants, with copies to the Design Agent, Consultants, Owner, participants, and others affected by the decisions made.

1.07 PREINSTALLATION MEETINGS

A. When required in the individual specification Sections, convene a pre-installation meeting at the site prior to commencing the Work of the Section.

B. Require attendance of the parties directly affecting, or affected by, the Work of the specific Section.

C. Notify the Design Agent four days in advance of the meeting date.

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

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

PART 2 - PRODUCTS

Not used.

PART 3 - EXECUTION

Not used.

END OF SECTION

01 3010 ADMINISTRATIVE REQUIREMENTS - Attachment A

A. Pre-installation Meetings

1. The following items of work will require pre-installation meetings:
    a. Demolition
    b. Metal Ceiling

END OF ATTACHMENT

01 3020 ADMINISTRATIVE REQUIREMENTS - Attachment B:
Small Project Changes

A. The following amendments are made to this Section in order to facilitate execution of smaller projects at URI. They apply to the work of this project. All portions of the specification Section not deleted or amended remain in full force and effect for this project.

B. Replace headings 1.01 C, D, E, and F with "C. Meetings".

C. Delete paragraphs 1.04, 1.05 and 1.07. Retitle 1.06 Progress Meetings to be "1.06 Meetings". Insert the words "or other requested" after "weekly" in 1.06 A. Delete subparagraph 1.06 D. Agenda. Meeting requirements may be less formal in small projects.

END OF ATTACHMENT

SECTION 01 3300 - SUBMITTAL PROCEDURES

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Submittal procedures.

B. Construction progress schedules.

C. Proposed products list.

D. Product data.

E. Shop drawings.

F. Design Data.

G. Samples.

H. Test reports.

I. Certificates.

J. Manufacturer's instructions.

K. Manufacturer's field reports.

L. Digital Photographs.

M. Erection drawings.

N. Construction photographs.

1.02 SUBMITTAL PROCEDURES

A. Master List Submittal:
   1. Submit a master list of the required submittals with a proposed date for each item to be submitted. See Attachment A for initial minimum list on which to base master.
   2. Show the date submittal was sent, days since submittal was sent, status of submittal, date submittal was received in return, and any date associated with resubmittals.
   3. Up date master list with each submission and response.
   4. Issue copy of master list at least monthly to the Design Agent.

B. Transmit each submittal with a dated Design Agent-accepted transmittal form.

C. Transmit printed copies and electronic PDF copy of each submittal to the Design Agent for review and comment as outlined in each section below.

D. Sequentially number the transmittal form. Mark revised submittals with an original number and a sequential alphabetic suffix.

E. Identify the Project, Contractor, subcontractor and supplier; the pertinent drawing and detail number, and the specification Section number, appropriate to the submittal.

F. Apply a Contractor's electronic stamp certifying that the review, approval, verification of products required, field dimensions, adjacent construction Work, and coordination of the information is in accordance with the requirements of the Work and the Contract Documents.

G. Schedule submittals to expedite the Project, and deliver to the Design Agent’s FTP site. Coordinate the submission of related items.

H. For each submittal, allow 15 days for review.

I. Identify all variations from the Contract Documents and any Product or system limitations which may be detrimental to a successful performance of the completed Work.

J. Allow space on the submittals for the Contractor's, Design Agent’s, and Consultant's electronic review stamps.

K. When revised for resubmission, identify the changes made since the previous submission.

L. Distribute copies of the reviewed submittals as appropriate. Reproduce as necessary to inform subcontractors without internet download capabilities. Instruct the parties to promptly report any inability to comply with the Contract requirements.

M. Produce additional copies as required for the Record Document purposes as described in Section 01 7800.

1.03 CONSTRUCTION PROGRESS SCHEDULES

A. Submit initial progress schedule in duplicate within 20 days after Date of Commencement for Design Agent to review. After a review, submit detailed schedules within 15 days modified to accommodate the revisions recommended by the Design Agent and Owner.

B. Distribute copies of the reviewed schedules to the Project site file, subcontractors, suppliers, and other concerned parties. Instruct the recipients to promptly report, in writing, the problems anticipated by the projections indicated in the schedules

C. Submit updated schedules with each Application for Payment, identifying changes since previous version as follows:
   1. Indicate the progress of each activity to the date of submittal, and the projected completion date of each activity.
   2. Identify the activities modified since the previous submittal, major changes in the scope, and other identifiable changes.
   3. Provide a narrative report to define the problem areas, the anticipated delays, and impact on the Schedule. Report the corrective action taken, or proposed, and its effect including the effect of changes on the schedules of separate contractors.

D. Submit a computer-generated horizontal bar chart with separate line for each major portion of the Work or operation, identifying the first work day of each week.

E. Show a complete sequence of construction by activity, identifying the Work of separate stages and other logically grouped activities. Indicate the early and late start, the early and late finish, float dates, and duration.

F. Indicate an estimated percentage of completion for each item of the Work at each submission.

G. Provide a separate schedule of submittal dates for shop drawings, product data, and samples, including Owner-furnished Products and Products identified under Allowances, if any, and the dates reviewed submittals will be required from the Design Agent. Indicate the decision dates for selection of the finishes.

H. Indicate the delivery dates for Owner furnished Products, and for Products identified under Allowances.

1.04 PROPOSED PRODUCTS LIST

A. Within 20 days after the Date of Commencement, submit a list of major products proposed for use, with the name of the manufacturer, the trade name, and the model number of each product.

B. For the products specified only by reference standards, give the manufacturer, trade name, model or catalog designation, and reference standards.

C. With each product listed, indicate the submittal requirements specified to be adhered to, and an indication of relevant "long-lead-time" information , when appropriate.

1.05 PRODUCT DATA

A. Product Data: Submit to the Design Agent for review for the limited purpose of checking for conformance with the information given and the design concept expressed in the Contract Documents. Provide copies and distribute in accordance with the SUBMITTAL PROCEDURES article and for the record documents purposes described in Section 01 7800.

B. Submit one (1) printed copy and one (1) electronic PDF copy for review. The Design Agent will retain the reviewed printed copy for record and return the reviewed electronic PDF copy to the Contractor for distribution.

C. Mark each copy to identify the applicable products, models, options, and other data. Supplement the manufacturers' standard data to provide the information specific to this Project.

D. Indicate the product utility and electrical characteristics, the utility connection requirements, and the location of utility outlets for service for functional equipment and appliances.

E. After a review distribute in accordance with the Submittal Procedures article above and provide copies for record documents described in Section 01 7800.

1.06 SHOP DRAWINGS

A. Shop Drawings: Submit to the Design Agent for review for the limited purpose of checking for conformance with the information given and the design concept expressed in the Contract Documents. Produce copies and distribute in accordance with the SUBMITTAL PROCEDURES article and for the record documents purposes described in Section 01 7800.

B. Submit two (2) printed copies and one (1) electronic PDF copy for review. The Design Agent and /or Consultants will retain the reviewed printed copies for record and return the reviewed electronic PDF copy to the Contractor for distribution.

C. Indicate the special utility and electrical characteristics, the utility connection requirements, and the location of utility outlets for service for functional equipments and appliances.

1.07 SAMPLES

A. Samples: Submit to the Design Agent for review for the limited purpose of checking for conformance with the information given and the design concept expressed in the Contract Documents. Produce duplicates and distribute in accordance with the

SUBMITTAL PROCEDURES article and for the record documents purposes described in Section 01 7800.

B. Samples for Selection as Specified in Product Sections:
   1. Submit to the Design Agent for aesthetic, color, or finish selection.
   2. Submit samples of the finishes in the colors selected for the Design Agent's records.
   3. After review, produce duplicates and distribute in accordance with the SUBMITTAL PROCEDURES article and for the record documents purposes described in Section 01 7800.

C. Submit samples to illustrate the functional and aesthetic characteristics of the product, with integral parts and attachment devices. Coordinate the sample submittals for interfacing Work.

F. Include identification on each sample, with the full Project information.

G. Submit at least the number of samples specified in the individual specification Sections; the Design Agent will retain two samples.

H. Reviewed samples, which may be used in the Work, are indicated in the individual specification Sections.

I. Samples will not be used for testing purposes unless they are specifically stated to be in the specification Section.

1.08 TEST REPORTS

A. Submit (1) printed and (1) electronic PDF lab reports in accordance with Section 01 4000.

B. Submit test reports for information for the limited purpose of assessing conformance with the information given and the design concept expressed in the Contract Documents.

1.09 DESIGN DATA

A. Submit (1) printed and (1) electronic PDF data for the Design Agent’s knowledge as contract administrator for the Owner.

B. Submit information for the limited purpose of assessing conformance with the information given and the design concept expressed in the Contract Documents.

1.10 CERTIFICATES

A. When specified in the individual specification Sections, submit (1) printed and (1) electronic PDF certification by the manufacturer, installation/application subcontractor, or the Contractor to the Design Agent in the quantities specified for the Product Data.

B. Indicate that the material or product conforms to or exceeds the specified requirements. Submit supporting reference data, affidavits, and certifications as appropriate.

A. Certificates may be recent or previous test results on the material or product, but must be acceptable to the Design Agent and its Consultants.

1.10 MANUFACTURER'S INSTRUCTIONS

A. When specified in the individual specification Sections, submit (1) printed and (1) electronic PDF copy of instructions for delivery, storage, assembly, installation, start-up, adjusting, and finishing, to the Design Agent for delivery to the Owner in the quantities specified for Product Data.

B. Indicate the special procedures, and the perimeter conditions requiring special attention, and the special environmental criteria required for application or installation.

1.11 MANUFACTURER'S FIELD REPORTS

A. Submit (1) printed and (1) electronic PDF of reports for the Design Agent's benefit as contract administrator for the Owner.

B. Submit the report within 30 days of observation to the Design Agent for the limited purpose of assessing conformance with the information given and the design concept expressed in the Contract Documents.

1.12 DIGITAL PHOTOGRAPHS

A. Submit minimum 12 digital photographs of construction progress each month on the same CD as the project schedule submittal. Include both jpg. and reduced-size PDF versions for email use.

B. Include an additional minimum of 12 photographs documenting underground utilities when installed in relationship to visible site features.

C. Include photographs of important in-wall or ceiling utilities before close-in at appropriate stages of construction.

D. See Section 01 7800 for close-out copy requirements of these files.

1.13 ERECTION DRAWINGS

A. When specified in the individual Specification sections, the trade contractors shall submit (1) printed and (1) electronic PDF copy of erection drawings for review prior to proceeding with fabrication and/or construction.

B. Erection drawings shall be prepared in accordance with the latest edition of the respective trades' codes of standard practice.

C. All erection drawings shall be fully developed by the trade contractors or by agents of the contractors. CAD files, photocopies, or other reproductions of the contract drawings in whole or in part shall not be used by the trade contractors or their agents for the preparation and development of erections drawings without the expressed written consent of the Design Agent.

PART 2 - PRODUCTS

Not Used.

PART 3 - EXECUTION

Not Used.

END OF SECTION

01 3310 SUBMITTAL PROCEDURES - Attachment A

A. Submittal List

A. See individual specifications for elements that will require submission of submittals in accordance with **Section 01 3300 – SUBMITTAL PROCEDURES**.

Spec. Section	Specification Section Description	Submittal
06 4100	WOOD CASEWORK	Millwork Samples
08 1213	DOORS & FRAMES	Product Data
08 7100	DOOR HARDWARE	Product Data
09 5100	ACOUSTICAL CEILINGS	Ceiling Product Data
09 5100	ACOUSTICAL CEILINGS	Metal Ceiling Product Data and Samples
09 6813	TILE CARPETING	Carpet Product Data and Samples
09 9000	PAINTING & COATING	Product Data

B. Additional Submittals

1. The Owner and/or Design Agent may request additional informational submittals (samples, shop drawings, material data sheets) from the Contractor for any materials to be incorporated into the construction. Said submittals shall be provided in accordance with Section 01 3300 at no additional expense to the Owner.

END OF ATTACHMENT

01 3320 SUBMITTAL PROCEDURES - Attachment B
Small Project Changes

A. The following amendments are made to this Section in order to facilitate execution of smaller projects at URI. They apply to the work of this project. All portions of the specification Section not deleted or amended remain in full force and effect for this project.

B. Delete headings 1.01 C, F, L, M, and N. Submittal requirements are reduced for small projects.

C. Replace subparagraph 1.02 A with the following:
"A. Submit all information listed in the Master List provided in Attachment A."

D. Delete paragraphs 1.12 and 1.13.

END OF ATTACHMENT

SECTION 01 4000 – QUALITY REQUIREMENTS

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Quality control and control of installation.

B. Verification of Credentials and Licenses.

C. Tolerances

D. References.

E. Testing and inspection services.

F. Manufacturers' field services.

G. Mock-up Requirements.

1.02 QUALITY CONTROL AND CONTROL OF INSTALLATION

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

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

C. When the manufacturers' instructions conflict with the Contract Documents, request a clarification from the Design Agent before proceeding.

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

E. Perform the Work by persons qualified to produce the required and specified quality.

F. Verify that field measurements are as indicated on the 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, or disfigurement.

1.03 VERIFICATION OF CREDENTIALS AND LICENSES

A. The Owner has implemented a project management oversight process and is applying it to current construction projects at URI.

B. An element of this oversight process is the verification that persons employed on the project site have appropriate and current credentials and licenses in their possession, at the project site, for the work they are performing.

C. Be forewarned that state resident inspectors will be checking for verification of credentials and licenses of both union and non-union persons, in their onsite inspections.

D. State resident inspectors will also be reviewing Contractor's Certified Monthly Payroll Records for conformance with RI State Prevailing Wage Rate requirements.

E. Those persons without the appropriate credentials and licenses will be subject to dismissal from the project site.

1.04 TOLERANCES

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

B. Comply with the manufacturers' tolerances. When the manufacturers' tolerances conflict with the Contract Documents, request a clarification from the Design Agent before proceeding.

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

1.05 REFERENCES

A. For products or workmanship specified by association, trade, or other consensus standards, comply with requirements of the standard, except when more rigid requirements are specified or are required by applicable codes.

B. Conform to reference standard by the date of issue current on the date of the Contract Documents, except where a specific date is established by code.

C. Obtain copies of the standards where required by the product specification Sections.

D. When the specified reference standards conflict with the Contract Documents, request a clarification from the Design Agent before proceeding.

E. Neither the contractual relationships, duties, or responsibilities of the parties in the Contract, nor those of the Design Agent, shall be altered from the Contract Documents by mention or inference otherwise in reference documents.

1.06 TESTING AND INSPECTION SERVICES

A. The Contractor will submit the name of an independent firm to the Design Agent for approval by the Owner, to perform the testing and inspection services. The Contractor shall pay for all the services required in the Base Bid as described in Attachment A. Contractor shall coordinate any Owner-authorized testing also described in Attachment A, to be paid for from Testing Allowance.

B. The independent firm will perform the tests, inspections and other services specified in the individual specification Sections and as required by the Design Agent or its Consultants.
1. Laboratory: Authorized to operate in the location in which the Project is located.
2. Laboratory Staff: Maintain a full time registered Engineer on staff to review the services.
3. Testing Equipment: Calibrated at reasonable intervals with devices of an accuracy traceable to either the National Bureau of Standards or to the accepted values of natural physical constants.

C. Testing, inspections and source quality control may occur on or off the project site. Perform off-site testing as required by the Design Agent or the Owner.

D. Reports will be submitted by the independent firm to the Design Agent, the Consultant for that trade, and the Contractor, in duplicate, indicating the observations and results of tests and indicating the compliance or non-compliance with Contract Documents.

E. Cooperate with the independent firm; furnish samples of the materials, design mix, equipment, tools, storage, safe access, and the assistance by incidental labor as requested.
1. Notify the Design Agent and Engineer and the independent firm 24 hours prior to the expected time for operations requiring services.
2. Make arrangements with the independent firm and pay for additional samples and tests required for the Contractor's use.

F. Testing and employment of the testing agency or laboratory shall not relieve the Contractor of an obligation to perform the Work in accordance with the requirements of the Contract Documents.

G. Re-testing or re-inspection required because of a non-conformance to the specified requirements shall be performed by the same independent firm on instructions by the Design Agent or its Consultant. Payment for the re-testing or re-inspection will be charged to the Contractor by deducting the testing charges from the Contract Sum.

H. Agency Responsibilities:
1. Test samples of mixes submitted by the Contractor.
2. Provide qualified personnel at the site. Cooperate with the Design Agent or its Consultant and the Contractor in performance of services.
3. Perform specified sampling and testing of the products in accordance with the specified standards.
4. Ascertain compliance of the materials and mixes with the requirements of the Contract

Documents.

5. Promptly notify the Design Agent, Consultant and the Contractor of observed irregularities or non-conformance of the Work or products.
6. Perform additional tests required by the Design Agent or its Consultants.
7. Attend the preconstruction meetings and the progress meetings.

I. Agency Reports: After each test, promptly submit two copies of the report to the Design Agent, appropriate Consultant, and to the Contractor. When requested by the Design Agent, provide an interpretation of the test results. Include the following:

1. Date issued.
2. Project title and number.
3. Name of inspector.
4. Date and time of sampling or inspection.
5. Identification of product and specifications section.
6. Location in the Project.
7. Type of inspection or test.
8. Date of test.
9. Results of tests.
10. Conformance with Contract Documents.

J. Limits On Testing Authority:

1. Agency or laboratory may not release, revoke, alter, or enlarge on the requirements of the Contract Documents.
2. Agency or laboratory may not approve or accept any portion of the Work.
4. Agency or laboratory may not assume any duties of the Contractor.
5. Agency or laboratory has no authority to stop the Work.

1.08 MANUFACTURERS' FIELD SERVICES

A. When specified in the individual specification Sections, require the material or Product suppliers, or manufacturers, to provide qualified staff personnel to observe the site conditions, the conditions of the surfaces and installation, the quality of workmanship, the start-up of equipment, or test, adjust and balance of equipment as applicable, and to initiate instructions when necessary.

B. Submit the qualifications of the observer to the Design Agent 30 days in advance of the required observations. Observer is subject to approval of the Design Agent.

C. Report the observations and the site decisions or instructions given to the applicators or installers that are supplemental or contrary to the manufacturers' written instructions.

D. Refer to Section 01 3300 - SUBMITTAL PROCEDURES, MANUFACTURERS' FIELD REPORTS article.

1.09 MOCK-UP REQUIREMENTS

A. Assemble and erect specified items with specified attachment and anchorage devices, flashings, seals, and finishes.

B. Accepted mock-ups shall be a comparison standard for the remaining Work.

C. Where mock-up has been accepted by Design Agent and is no longer needed, remove mock-up and clear area when directed to do so.

PART 2 - PRODUCTS

Not Used.

PART 3 - EXECUTION

Not used.

END OF SECTION

01 4010 QUALITY REQUIREMENTS - Attachment A

A. Base Bid Testing Requirements List

1. Refer to Mechanical, Electrical, Plumbing and Fire .

B. Additional Owner-Authorized Testing Requirements List

1. None

C. Other

1. Not Applicable

END OF ATTACHMENT

01 4020 QUALITY REQUIREMENTS - Attachment B
Small Project Changes

A. The following amendments are made to this Section in order to facilitate execution of smaller projects at URI. They apply to the work of this project. All portions of the specification Section not deleted or amended remain in full force and effect for this project.

B. Delete header 1.01 G. Delete paragraph 1.09. No mock-ups required.

END OF ATTACHMENT

SECTION 01 5000 - TEMPORARY FACILITIES AND CONTROLS

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Temporary Utilities:
   1. Temporary electricity.
   2. Temporary lighting for construction purposes.
   3. Temporary heating.
   4. Temporary cooling.
   5. Temporary ventilation.
   6. Telephone service.
   7. Temporary water service.
   8. Temporary sanitary facilities.

B. Construction Facilities:
   1. Field offices and sheds.
   2. Hoisting.
   3. Parking/Traffic.
   4. Progress cleaning and waste removal.
   5. Project identification.
   6. Traffic regulation.

C. Temporary Controls:
   1. Barriers.
   2. Enclosures and fencing.
   3. Security.
   4. Fire detection.
   5. Water control.
   6. Dust control.
   7. Erosion and sediment control.
   8. Noise control.
   9. Pest control.
   10. Pollution control.
   11. Rodent control.

D. Removal of utilities, facilities, and controls with reseeding and repair of grounds.

E. See Attachment A for any modifications.

1.02 TEMPORARY ELECTRICITY

A. The Owner will pay the cost of energy used. Exercise measures to conserve energy. Utilize the Owner's existing power service.
B. Complement the existing power service capacity and characteristics as required for construction operations.

C. Provide power outlets, with branch wiring and distribution boxes located at each floor or as required for construction operations. Provide flexible power cords as required for portable construction tools and equipment. All flexible power cords shall be suspended with hangers to eliminate trip hazards.

D. Provide main service disconnect and over-current protection at a convenient location, or a feeder switch at the source distribution equipment or meter.

E. Permanent convenience receptacles may not be utilized during construction.

F. Provide distribution equipment, wiring, and outlets to provide single-phase branch circuits for power. Provide 20-ampere duplex outlets, single-phase circuits for power tools.

1.03 TEMPORARY LIGHTING FOR CONSTRUCTION PURPOSES

A. Provide and maintain incandescent lighting for construction operations to achieve a minimum lighting level of 2 watt/sq ft (21 watt/sq m).

B. Provide branch wiring from power source to distribution boxes with lighting conductors, pigtails, and lamps as required.

C. Maintain lighting and provide routine repairs.

D. Permanent building lighting may be utilized during construction where not removed.

1.04 TEMPORARY HEATING

A. Existing facilities will be occupied and heated by the University when temperatures require. Take care to avoid leaving doors open in exterior walls that could compromise heating operations. For new construction, the cost of energy will be borne by the Contractor. Provide temporary heating as necessary for construction operations.

B. Supplement with temporary heat devices if needed to maintain the specified conditions for construction operations even in existing buildings.

C. Maintain a minimum ambient temperature of 50 degrees F in the areas where construction is in progress, unless indicated otherwise in the product Sections.

D. In areas of work with mechanical hot-air heating, clean units and replace filters after Substantial Completion.

E. Do not use new equipment for heating after replacement during construction.

1.05 TEMPORARY COOLING

A. Existing cooling facilities are typically not available.

B. Provide and pay for cooling devices and cooling as needed to maintain the specified conditions for construction operations.

C. Maintain a maximum ambient temperature of 80 degrees F in the areas where construction is in progress, unless indicated otherwise in the specifications.

1.06 TEMPORARY VENTILATION

A. Ventilate enclosed areas to achieve a curing of materials, to dissipate humidity, and to prevent the accumulation of dust, fumes, vapors, or gases.

B. If existing ventilation fans are used during construction, clean fans in areas of work after Substantial Completion.

1.07 TELEPHONE SERVICE

A. Provide, maintain, and pay for cell phone service to the field supervisor at the time of project mobilization and until project Final Completion.

1.08 TEMPORARY WATER SERVICE

A. The Owner will pay the cost of temporary water. Exercise measures to conserve energy. Utilize the Owner's existing water system, extend and supplement with temporary devices as needed to maintain the specified conditions for construction operations.

B. Extend branch piping with outlets located so that water is available by hoses with threaded connections. Provide temporary pipe insulation if needed to prevent freezing.

1.09 TEMPORARY SANITARY FACILITIES

A. Contractor shall provide and maintain temporary toilet facilities for use by all construction personnel. Trades people will not be permitted to use existing facilities within the building.

1.10 FIELD OFFICES AND SHEDS

A. Do not use existing facilities for storage. Job meetings will be held on campus at a location to be chosen by the University.

B. Storage Areas and Sheds: Size to the storage requirements for the products of the individual Sections, allowing for access and orderly provision for the maintenance and for the inspection of Products to the requirements of Section 01 6000. Containers will be permitted within the project limit line. Coordinate with URI for storage areas.

C. Preparation: Fill and grade the sites for the temporary structures to provide drainage away from the buildings.

D. Removal: At the completion of the Work remove the buildings, foundations, utility services, and debris. Restore the areas.

1.11 HOISTING

A. Contractor is responsible for all hoisting required to facilitate, serve, stock, clean, and complete the Work. Include all costs for Operating Engineers, fuel, delivery and removal, mobilization, staging, protection of grades and surfaces, and equipment.

1.12 PARKING/TRAFFIC

A. Workers must park in lots assigned by the University with daily permits. See Site Utilization Plan.

B. Use of designated existing on-site streets and driveways for construction traffic is permitted. Tracked vehicles are not allowed on paved areas.

C. Do not allow heavy vehicles or construction equipment in parking areas.

D. Do not allow vehicle parking on existing sidewalks.

E. Provide and maintain access to fire hydrants and control valves free of obstructions.

F. Remove mud from construction vehicle wheels before entering streets. Cleanup dirt, rocks, and debris left on street from construction vehicles.

G. Use designated existing on-site roads for construction traffic.

H. Maintenance:
   1. Maintain the traffic and parking areas in a sound condition free of excavated material, construction equipment, products, mud, snow, and ice.
   2. Maintain existing and permanent paved areas used for construction; promptly repair breaks, potholes, low areas, standing water, and other deficiencies, to maintain the paving and drainage in original, or specified, condition.

I. Removal, Repair:
   1. Remove temporary materials and at Substantial Completion.
   2. Remove underground work and compacted materials to a depth of 2 feet; fill and grade the site as specified.
   3. Repair existing and permanent facilities damaged by use, to the original or specified condition.

1.13 PROGRESS CLEANING AND WASTE REMOVAL

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

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

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

D. Collect and remove waste materials, debris, and rubbish from the site daily, as necessary to prevent an on-site accumulation of waste material, debris, and rubbish, and dispose off-site.

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

1.14 PROJECT IDENTIFICATION

A. Project Identification Sign: One painted sign, 32 sq ft area, bottom 6 feet above the ground.
   1. Content:
      a. Project title, and name of the Owner as indicated on the Contract Documents.
      b. Names and titles of the authorities.
      c. Names and titles of the Design Agent and Consultants.
      d. Name of the Design Agent Contractor.
   2. Graphic Design, Colors, and Style of Lettering: 3 colors, as designated by the Design Agent during construction.

B. Project Informational Signs:
   1. Painted informational signs of same colors and lettering as the Project Identification sign, or standard products; size lettering to provide legibility at 100-foot distance.
   2. Provide sign at each field office, storage shed, and directional signs to direct traffic into and within site. Relocate as the Work progress requires.
   3. No other signs are allowed without the Owner's permission except those required by law.

C. Design all signs and their structures to withstand a 60-miles/hr-wind velocity.

D. Sign Painter: Experienced as a professional sign painter for a minimum of three years.

E. Finishes, Painting: Adequate to withstand weathering, fading, and chipping for the duration of construction.

F. Show content, layout, lettering, color, foundation, structure, sizes, and grades of members.

G. Installation:
   1. Install the project identification sign within 15 days after the date of receipt of the Purchase Order from State of Rhode Island Department of Administration, Division of Purchases.
   2. Erect at the designated location.
   3. Erect the supports and framing on a secure foundation, rigidly braced and framed to resist wind loadings.
   4. Install the sign surface plumb and level, with butt joints. Anchor securely.
   5. Paint exposed surfaces of the sign, supports, and framing.

H. Maintenance: Maintain the signs and supports clean, repair deterioration and damage.

I. Removal: Remove the signs, framing, supports, and foundations at the completion of the Project and restore the area.

1.15 TRAFFIC REGULATION

A. Signs, Signals, and Devices:
   1. Post Mounted and Wall Mounted Traffic Control and Informational Signs: As approved by local jurisdictions.
   2. Traffic Cones and Drums, Flares and Lights: As approved by local jurisdictions.
   3. Flag person Equipment: As required by local jurisdictions.
   4. Police Details: Provide all police details as required by local jurisdictions, including payment directly to officers.

B. Flag Persons: Provide trained and equipped flag persons to regulate the traffic when construction operations or traffic encroach on the public traffic lanes.

C. Flares and Lights: Use flares and lights during the hours of low visibility to delineate the traffic lanes and to guide traffic.

D. Haul Routes:
   1. Consult with the authority having jurisdiction, establish the public thoroughfares to be used for haul routes and site access.

E. Traffic Signs and Signals:
   1. At approaches to the site and on site, install at crossroads, detours, parking areas, and elsewhere as needed to direct the construction and affected public traffic.
   2. Install and operate automatic traffic control signals to direct and maintain the orderly flow of traffic in areas under the Contractor's control, and areas affected by the Contractor's operations.
   3. Relocate as the Work progresses, to maintain effective traffic control.

F. Removal:
   1. Remove equipment and devices when no longer required.
   2. Repair damage caused by installation.
   3. Remove post settings to a depth of 2 feet .

1.16 BARRIERS

A. Provide barriers to allow for the Owner's use of the site and to protect existing facilities and adjacent properties from damage from the construction operations, or demolition.

B. Provide barricades and covered walkways required by governing authorities for public rights-of-way, or for public access to the building.

C. Provide protection for plants designated to remain. Replace damaged plants.

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

1.17 ENCLOSURES AND FENCING

A. Construction: Provide 6-ft. high commercial grade chain link fence around on-site equipment or areas of site disturbance for the period required to protect work and the public. Equip with vehicular and pedestrian gates with locks. Provide one set of keys to all gates and door locks to the Owner.

A. Perform adjustment to the proposed layout as may be directed by the Owner.

B. Interior Enclosures:
   1. Provide temporary partitions and ceilings as indicated to separate the work areas from Owner-occupied areas, to prevent penetration of dust and moisture into Owner-occupied areas, and to prevent damage to the existing materials and equipment.
   2. Construction: Framing and reinforced polyethylene, plywood, or gypsum board sheet materials with closed joints and sealed edges at intersections with existing surfaces, as agreed with the Owner:
      a. Maximum flame spread rating of 75 in accordance with ASTM E84.

1.18 SECURITY

A. Security Program:
   1. Protect the Work, the existing premises, or the Owner's operations from theft, vandalism, and unauthorized entry.
   2. Initiate the program in coordination with the Owner's existing security system at mobilization.
   3. Maintain the program throughout the construction period until Owner occupancy of each designated area.

B. Entry Control: Coordinate the access of the Owner's personnel to the site in coordination with the Owner's security forces.

1.19 FIRE DETECTION

A. Before beginning any construction operation that can potentially trigger the existing fire alarm detection system, notify the Owner through use of the form provided in Section 01 1020.

B. Failure to so notify the Owner will subject the Contractor to a monetary fine for each occurrence, should the fire detection system be activated inadvertently by a construction activity.

C. Comply with FM Global insurance underwriting standards and insurer recommendations for Hot Work, sprinkler impairment, and site maintenance.

1.20 WATER CONTROL

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

B. Protect the site from puddling or running water. Provide water barriers as required to protect the site from soil erosion.

1.21 DUST CONTROL

A. Execute the Work by methods to minimize raising dust from construction operations.

B. Provide positive means to prevent air-borne dust from dispersing into the atmosphere.

1.22 EROSION AND SEDIMENT CONTROL

A. Plan and execute construction by methods to control surface drainage from cuts and fills, from borrow and waste disposal areas. Prevent erosion and sedimentation.

B. Minimize the amount of bare soil exposed at one time.

C. Provide temporary measures such as berms, dikes, and drains, to prevent water flow.

D. Construct fill and waste areas by selective placement to avoid erosive surface silts or clays.

E. Periodically inspect the earthwork to detect evidence of erosion and sedimentation; promptly apply corrective measures.

1.23 NOISE CONTROL

A. Provide methods, means, and facilities to minimize noise produced by the construction operations.

1.24 PEST CONTROL

A. Provide methods, means, and facilities to prevent pests and insects from damaging the Work, or entering the facility.

1.25 POLLUTION CONTROL

A. Provide methods, means, and facilities to prevent the contamination of soil, water, and the atmosphere from discharge of noxious, toxic substances, and pollutants produced by the construction operations.

1.26 RODENT CONTROL

A. Provide methods, means, and facilities to prevent rodents from accessing or invading the premises.

1.27 REMOVAL OF UTILITIES, FACILITIES, AND CONTROLS

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

B. Remove the underground installations to a minimum depth of 2 feet. Grade the site as indicated.

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

D. Restore the existing and new facilities used during construction to their original condition.

E. Restore any temporary exterior laydown or storage areas to the original condition. After each use, regrade and reseed as required to meet this requirement.

PART 2 - PRODUCTS

Not Used.

PART 3 - EXECUTION

Not Used.

END OF SECTION

01 5010 TEMPORARY FACILITIES AND CONTROLS - ATTACHMENT A

1.01 SECTION INCLUDES

A. Comply with the following provisions, taking every effort to conserve energy:
   1. Temporary electricity - utilize building power without bringing cords across hallways.
   2. Temporary lighting for construction purposes – as required.
   3. Temporary heating – as required.
   4. Temporary cooling – as required.
   5. Temporary ventilation – as required.
   6. Telephone service - site supervisor to maintain cell phone contact.
   7. Facsimile service – electronic submittal of shop drawings will be required via scans and email. Fax is no longer acceptable.
   8. Temporary water service – may use building water where directed.
   9. Temporary sanitary facilities – Contractor may use the existing facilities within the Dean's suite only, use of public restrooms in building lobbies is not permitted. Contractor will have total control of the facilities within the suite and will be responsible for housekeeping for the duration of the project. Contractor will be responsible for returning the facilities to original condition and to the satisfaction of the the URI Custodial staff at substantial completion.

END OF ATTACHMENT

01 5020 TEMPORARY FACILITIES AND CONTROLS - Attachment B
Small Project Changes

A. The following amendments are made to this Section in order to facilitate execution of smaller projects at URI. They apply to the work of this project. All portions of the specification Section not deleted or amended remain in full force and effect for this project.

B. Delete all lines 1.01 A.1thru 8 and B.1 thru 6. Delete paragraph 1.01 C.

C. Delete 1.02 B, C, D and E. Delete 1.03 A and B. Power distribution work not required.

D. Delete subparagraphs 1.10 C and D. No field offices temporary utilities anticipated on small projects.

E. Delete paragraph 1.11 Hoisting.

F. Delete subparagraphs 1.12 H and I.

G. Delete paragraphs 1.14, 1.15, 1.16, 1.17, 1.20, 1.22, 1.24, 1.26 and subparagraph 1.27 B, assuming that most small projects do not involve enclosure requirements or exterior/ sitework changes.

END OF ATTACHMENT

SECTION 01 6000 - PRODUCT REQUIREMENTS

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Products.

B. Product delivery requirements.

C. Product storage and handling requirements.

D. Product options.

E. Product substitution procedures.

1.02 PRODUCTS

A. Products: Means new material, machinery, components, fixtures, or systems forming the Work; but does not include the machinery or equipment used for the preparation, fabrication, conveying, or erection of the Work. Products may include the existing materials or components required or specified for reuse.

B. Furnish products of qualified manufacturers suitable for the intended use. Furnish products of each type by a single manufacturer unless specified otherwise.

C. Do not use materials and equipment removed from the existing premises, except as specifically permitted by the Contract Documents.

D. Furnish interchangeable components of the same manufacturer for the components being replaced.

1.03 PRODUCT DELIVERY REQUIREMENTS

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

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

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

1.04 PRODUCT STORAGE AND HANDLING REQUIREMENTS

A. Store and protect the products in accordance with the manufacturers' instructions.

B. Store with seals and labels intact and legible.

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

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

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

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

G. Store loose granular materials on solid flat surfaces in a well-drained area. Prevent mixing with foreign matter.

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

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

1.05 PRODUCT OPTIONS

A. Products Specified by Reference Standards or by Description Only: Any Product meeting those standards or description.

B. Products Specified by Naming One or More Manufacturers: Products of one of the manufacturers named and meeting the 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 in accordance with the following article.

1.06 PRODUCT SUBSTITUTION PROCEDURES

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

B. Substitutions may be considered after the bid only in the following circumstances:
1. when a product becomes no longer in production following the date of receipt of the Purchase Order for this Contract. Submit certification both that specified product was carried in Bid, and is no longer obtainable. Provide cost change documentation.
2. there is a significant cost savings offered to the Owner. Provide price comparison of both bid and offered substitution products as well as all collateral costs of the change.

3. Code changes or site conditions require a different item from that bid. Submit as for 2 above.

C. Document each request with complete data substantiating the compliance of a proposed Substitution with the Contract Documents.

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

E. Substitutions will not be considered when they are indicated or implied on the Shop Drawing or Product Data submittals, without a separate written request, or when acceptance will require revision to the Contract Documents.

F. Substitution Submittal Procedure, If Permitted Following Contract Award:
   1. Submit three copies of a request for Substitution for consideration, no later than 20 working days following date of receipt of the Purchase Order for this Contract. Limit each request to one proposed Substitution.
   2. Submit the Shop Drawings, Product Data, and the certified test results attesting to the proposed product equivalence. The burden of proof is on the proposer.
   3. The Design Agent will notify the Contractor in writing of a decision to accept or reject the request. Costs for review time on unsuccessful requests will be included in the next change order.

PART 2 - PRODUCTS

Not Used.

PART 3 - EXECUTION

Not Used.

END OF SECTION

01 6010 PRODUCT REQUIREMENTS - Attachment A

A. No variations in this section for this Project.

END OF ATTACHMENT

PART 1 -
01 6020 PRODUCT REQUIREMENTS - Attachment B
Small Project Changes

A. The following amendments are made to this Section in order to facilitate execution of smaller projects at URI. They apply to the work of this project. All portions of the specification Section not deleted or amended remain in full force and effect for this project.

B. No amendments are necessary in the Section due to project size. See Attachment A for project specific amendments.

END OF ATTACHMENT

SECTION 01 7000 - EXECUTION REQUIREMENTS

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Examination.

B. Preparation.

C. Field Engineering.

D. Protection of adjacent construction.

E. Cutting and patching.

F. Special procedures.

G. Starting and adjusting of systems.

H. Demonstration and Instructions.

I. Testing, adjusting and balancing.

J. Protecting Installed Construction.

1.02 EXAMINATION

A. Acceptance of Conditions:
   1. Verify that existing applicable site conditions, substrates, or substrate surfaces are acceptable or meet specific requirements of individual specifications Sections, for subsequent Work to proceed.
   2. Verify that existing substrate is capable of structural support or attachment of new Work being applied or attached.
   3. Examine and verify specific conditions described in individual specifications Sections.
   4. Verify that utility services are available, of correct characteristics, and in correct locations.
   5. Beginning of new Work, that relies upon the quality and proper execution of Work of a preceding trade, means acceptance of that preceding Work as appropriate for the proper execution of subsequent Work.
   6. Acceptance of preceding Work that can be shown later to have adversely affected proper performance of new Work may result in removal and repeat performance of all Work involved at no cost to the Owner.

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

D. Prior to the application, installation, or erection of any products and product components, perform any other preparatory operations, or surface or substrate modifications, as may be specified or directed by product manufacturers.

1.04 FIELD ENGINEERING

A. Employ a Land Surveyor registered in the State of Rhode Island and acceptable to Design Agent and the Owner if required by subgrade work.

B. Locate and protect survey control and reference points. Promptly notify Design Agent of any discrepancies discovered.

C. Control Datum for survey is to be agreed to with the Design Agent.

D. Verify setbacks and easements, if any; confirm drawing dimensions and elevations.

E. Provide field-engineering services. Establish elevations, lines, and levels, utilizing recognized engineering survey practices.

F. Submit a copy of site drawings and certificate signed by the Land Surveyor that the elevations and locations of the Work are in conformance with the Contract Documents.

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

H. If required by the Owner, on completion of foundation walls and major site improvements, prepare a certified survey illustrating dimensions, locations, angles, and elevations of construction and site work.

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

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

K. Replace dislocated survey control point based on original survey control. Make no changes without prior written notice to Design Agent.

1.05 PROTECTION OF ADJACENT CONSTRUCTION

A. Protect existing adjacent properties and provide special protection where specified in individual Specification Sections.

B. Provide protective coverings at wall, projections, jambs, sills, and soffits of existing openings.

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

D. Cover and protect furnishings, materials and equipment within the spaces receiving new work. Move items as necessary to install new work and return them to original locations at the close of construction in that area.

E. Repair adjacent properties damaged by construction operations to original condition to the satisfaction of the Owner.

F. Prohibit unnecessary traffic from existing landscaped areas.

G. Restore grassed landscaped areas damaged by construction operations to full healthy growth, by installing loam and sod to the requirements, and under the supervision of, the University's Associate Director of Lands and Grounds.

1.06 CUTTING AND PATCHING

A. Employ skilled and experienced installers to perform cutting and patching.

B. Submit written request in advance of cutting or altering elements which affect:
   1. Structural integrity of element.
   2. Integrity of weather-exposed or moisture-resistant elements.
   3. Efficiency, maintenance, or safety of element.
   4. Visual qualities of sight-exposed elements.
   5. Existing construction, or Work of separate contractor.

C. Execute cutting, fitting, and patching including excavation and fill, to complete Work, and to:
   1. Fit the several parts together, to integrate with other Work.
   2. Uncover Work to install or correct ill-timed Work.
   3. Remove and replace defective and non-conforming Work.
   4. Remove samples of installed Work for testing.
   5. Provide openings in elements of Work for penetrations of mechanical and electrical Work.

D. Execute Work by methods that will avoid damage to other Work, and provide proper surfaces to receive patching and finishing.

E. Cut masonry, concrete, and other rigid materials using masonry saw or core drill.

F. Remove ceiling tiles as necessary to access areas of work. Store and replace carefully to avoid damage. Replace all ceiling tiles damaged during the work with new tiles to match. Repair ACT grid damaged during the work in accordance with this section.

G. Restore Work with new Products in accordance with requirements of Contract Documents.

H. Fit Work tight to pipes, sleeves, ducts, conduits, and other penetrations through surfaces.

I. Maintain integrity of wall, ceiling, or floor construction; completely seal voids.

J. At penetration of fire rated partitions, ceiling, or floor construction, completely seal voids with fire rated or fire resistant material in accordance with Specifications, to full thickness of the penetrated element.

K. Refinish surfaces to match adjacent finishes. For continuous surfaces, refinish to nearest intersection; for an assembly, refinish entire unit.

L. Identify any hazardous substance or conditions exposed during the Work to the Owner and Design Agent for decision or remedy.

M. See General Conditions for additional requirements.

1.07 SPECIAL PROCEDURES

A. Materials: As specified in product Sections; match existing with new products, or salvaged products as appropriate, for patching and extending work.

B. Employ skilled and experienced installer to perform alteration work.

C. Cut, move, or remove items as necessary for access to alterations and renovation Work. Replace and restore at completion.

D. Remove unsuitable material not marked for salvage, such as rotted wood, corroded metals, and deteriorated masonry and concrete. Replace materials as specified for finished Work.

E. Remove debris and abandoned items from area and from concealed spaces.

F. Prepare surface and remove surface finishes to provide installation of new Work and finishes.

G. Close openings in exterior surfaces to protect existing Work from weather and extremes of temperature and humidity.

H. Remove, cut, and patch Work in a manner to minimize damage and to provide means of restoring products and finishes to original or specified condition.

I. Refinish existing visible surfaces to remain in renovated rooms and spaces to specified condition for each material, with a neat transition to adjacent finishes.

J. Where new Work abuts or aligns with existing, provide a smooth and even transition. Patch Work to match existing adjacent Work in texture and appearance.

K. When finished surfaces are cut so that a smooth transition with new Work is not possible, terminate existing surface along a straight line at a natural line of division and submit recommendation to Design Agent for review.

L. Where a change of plane of 1/4 inch or more occurs, submit recommendation for providing a smooth transition to Design Agent for review.

M. Trim existing doors as necessary to clear new floor finish. Refinish trim as required.

N. Patch or replace portions of existing surfaces which are damaged, or showing other imperfections.

O. Finish surfaces as specified in individual product Sections, or as indicated on the Drawings.

1.08 STARTING AND ADJUSTING OF SYSTEMS

A. Coordinate schedule for starting and adjusting of various equipment and systems.

B. Notify Design Agent and Owner seven days prior to starting and adjusting of each item.

C. Verify that each piece of equipment or system has been checked for proper lubrication, drive rotation, belt tension, control sequence, or other conditions which may cause damage.

D. Verify that tests, meter readings and specified electrical characteristics agree with those required by the equipment or system manufacturer.

E. Verify wiring and support components for equipment are complete and tested.

F. Execute starting and adjusting under supervision of responsible Contractor's personnel or manufacturer's representative, in accordance with manufacturer's instructions.

G. Adjust operating Products and equipment to ensure smooth and unhindered operation.

H. When specified in individual specifications Section, require manufacturer to provide authorized representative to be present at the site to inspect, check, and approve equipment or system installation prior to starting, and to supervise placing of equipment or system in operation.

I. Submit a written report in accordance with Section 01400 that equipment or system has been properly installed and is functioning correctly.

1.09 DEMONSTRATION AND INSTRUCTIONS

A. Demonstrate operation and maintenance of Products to Owner's personnel two weeks prior to date of Substantial Completion.

B. For equipment or systems requiring seasonal operation, perform demonstration for other season within six months.

C. Utilize operation and maintenance manuals as basis for instruction. Review contents of manuals with Owner's personnel in detail to explain all aspects of operation and maintenance.

D. Demonstrate start-up, operation, control, adjustment, trouble shooting, servicing, maintenance, and shutdown of each item of equipment at scheduled or agreed upon times, at equipment or system location.

E. Prepare and insert additional data in operations and maintenance manuals when need for additional data becomes apparent during instruction.

1.10 TESTING, ADJUSTING, AND BALANCING

A. Submit, for the Owner's approval, the name of an independent firm to perform testing of fire systems. The independent firm's services will be paid for by the Contractor.

B. The independent firm will perform services specified in individual specifications Sections.

C. Reports will be submitted by the independent firm to the Design Agent and the Owner indicating observations and test results, indicating compliance or non-compliance with specified requirements and with the requirements of the Contract Documents.

1.11 PROTECTING INSTALLED CONSTRUCTION

A. Protect installed Work and provide special protection where specified in individual specification sections.

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

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

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

E. Repair or replace installed Work damaged by construction operations, as directed by the Design Agent.

PART 2 - PRODUCTS

Not Used.

PART 3 - EXECUTION

Not Used.

END OF SECTION

01 7010 EXECUTION REQUIREMENTS - Attachment A

A. Daily Attendance Form

1. Maintain Daily Attendance Form acceptable to the Department of Labor and Training for all projects with a contract value over $1Million. Submit as requested.

END OF ATTACHMENT

SECTION 01 7320

WASTE MANAGEMENT

PART 1 GENERAL

1.01 WASTE MANAGEMENT REQUIREMENTS

A. Owner requires that this project generate the least amount of trash and waste possible.

B. Employ processes that ensure the generation of as little waste as possible due to error, poor planning, breakage, mishandling, contamination, or other factors.

C. Minimize trash/waste disposal in landfills; reuse, salvage, or recycle as much waste as economically feasible.

D. Required Recycling, Salvage, and Reuse: The following may not be disposed of in landfills or by incineration:
   1. Aluminum and plastic beverage containers.
   2. Corrugated cardboard.
   3. Wood pallets.
   4. Clean dimensional wood: May be used as blocking or furring.
   5. Land clearing debris, including brush, branches, logs, and stumps.
   6. Metals, including packaging banding, metal studs, sheet metal, structural steel, piping, reinforcing bars, door frames, and other items made of steel, iron, galvanized steel, stainless steel, aluminum, copper, zinc, lead, brass, and bronze.
   7. Glass.
   8. Gypsum drywall and plaster.
   9. Plastic buckets.
   10. Paper, including wrapping, newsprint, and office.

E. Contractor shall submit periodic Waste Disposal Reports; all landfill disposal, incineration, recycling, salvage, and reuse must be reported regardless of to whom the cost or savings accrues; use the same units of measure on all reports. Submit in accordance with Section 01 3300.

F. Contractor shall develop and follow a Waste Management Plan designed to implement these requirements.

G. Methods of trash/waste disposal that are not acceptable are:
   1. Burning on the project site.
   2. Burying on the project site.
   3. Dumping or burying on other property, public or private.
   4. Other illegal dumping or burying.

H. Regulatory Requirements: Contractor is responsible for knowing and complying with regulatory requirements, including but not limited to Federal, state and local requirements, pertaining to legal disposal of all construction and demolition waste materials.

1.02 RELATED REQUIREMENTS

A. Section 01 3000 - Administrative Requirements: Additional requirements for project meetings, reports, submittal procedures, and project documentation.

B. Section 01 5000 - Temporary Facilities and Controls: Additional requirements related to trash/waste collection and removal facilities and services.

C. Section 01 6000 - Product Requirements: Waste prevention requirements related to delivery, storage, and handling.

D. Section 01 7000 - Execution Requirements: Trash/waste prevention procedures related to

demolition, cutting and patching, installation, protection, and cleaning.

1.03 DEFINITIONS

A. Clean: Untreated and unpainted; not contaminated with oils, solvents, caulk, or the like.

B. Construction and Demolition Waste: Solid wastes typically including building materials, packaging, trash, debris, and rubble resulting from construction, remodeling, repair and demolition operations.

C. Hazardous: Exhibiting the characteristics of hazardous substances, i.e., ignitibility, corrosivity, toxicity or reactivity.

D. Nonhazardous: Exhibiting none of the characteristics of hazardous substances, i.e., ignitibility, corrosivity, toxicity, or reactivity.

E. Nontoxic: Neither immediately poisonous to humans nor poisonous after a long period of exposure.

F. Recyclable: The ability of a product or material to be recovered at the end of its life cycle and remanufactured into a new product for reuse by others.

G. Recycle: To remove a waste material from the project site to another site for remanufacture into a new product for reuse by others.

H. Recycling: The process of sorting, cleansing, treating and reconstituting solid waste and other discarded materials for the purpose of using the altered form. Recycling does not include burning, incinerating, or thermally destroying waste.

I. Return: To give back reusable items or unused products to vendors for credit.

J. Reuse: To reuse a construction waste material in some manner on the project site.

K. Salvage: To remove a waste material from the project site to another site for resale or reuse by others.

L. Sediment: Soil and other debris that has been eroded and transported by storm or well production run-off water.

M. Source Separation: The act of keeping different types of waste materials separate beginning from the first time they become waste.

N. Toxic: Poisonous to humans either immediately or after a long period of exposure.

O. Trash: Any product or material unable to be reused, returned, recycled, or salvaged.

P. Waste: Extra material or material that has reached the end of its useful life in its intended use. Waste includes salvageable, returnable, recyclable, and reusable material.

1.04 SUBMITTALS

A. See Section 01 3300 for submittal procedures.

B. Waste Management Plan: Include the following information:
   1. Analysis of the trash and waste projected to be generated during the entire project construction cycle, including types and quantities.
   2. Landfill Options: The name, address, and telephone number of the landfill(s) where trash/waste will be disposed of, the applicable landfill tipping fee(s), and the projected cost of disposing of all project trash/waste in the landfill(s).
   3. Landfill Alternatives: List all waste materials that will be diverted from landfills by reuse, salvage, or recycling.
   4. Meetings: Describe regular meetings to be held to address waste prevention, reduction, recycling, salvage, reuse, and disposal.

5. Materials Handling Procedures: Describe the means by which materials to be diverted from landfills will be protected from contamination and prepared for acceptance by designated facilities; include separation procedures for recyclables, storage, and packaging.
6. Transportation: Identify the destination and means of transportation of materials to be recycled; i.e. whether materials will be site-separated and self-hauled to designated centers, or whether mixed materials will be collected by a waste hauler.

C. Waste Disposal Reports: Submit at specified intervals, with details of quantities of trash and waste, means of disposal or reuse, and costs; show both totals to date and since last report.
1. Submit updated Report with each Application for Progress Payment; failure to submit Report will delay payment.
2. Submit Report on a form acceptable to Owner.
3. Landfill Disposal: Include the following information:
   a. Identification of material.
   b. Amount, in tons or cubic yards, of trash/waste material from the project disposed of in landfills.
   c. State the identity of landfills, total amount of tipping fees paid to landfill, and total disposal cost.
   d. Include manifests, weight tickets, receipts, and invoices as evidence of quantity and cost.
4. Incinerator Disposal: Include the following information:
   a. Identification of material.
   b. Amount, in tons or cubic yards, of trash/waste material from the project delivered to incinerators.
   c. State the identity of incinerators, total amount of fees paid to incinerator, and total disposal cost.
   d. Include manifests, weight tickets, receipts, and invoices as evidence of quantity and cost.
5. Recycled and Salvaged Materials: Include the following information for each:
   a. Identification of material, including those retrieved by installer for use on other projects.
   b. Amount, in tons or cubic yards, date removed from the project site, and receiving party.
   c. Transportation cost, amount paid or received for the material, and the net total cost or savings of salvage or recycling each material.
   d. Include manifests, weight tickets, receipts, and invoices as evidence of quantity and cost.
   e. Certification by receiving party that materials will not be disposed of in landfills or by incineration.
6. Material Reused on Project: Include the following information for each:
   a. Identification of material and how it was used in the project.
   b. Amount, in tons or cubic yards.
   c. Include weight tickets as evidence of quantity.
7. Other Disposal Methods: Include information similar to that described above, as appropriate to disposal method.

PART 2 PRODUCTS (not used)

PART 3 EXECUTION

3.01 WASTE MANAGEMENT PROCEDURES

A. See Section 01 1000 for list of items to be salvaged from the existing building for relocation in project or for Owner.

B. See Section 01 3000 for additional requirements for project meetings, reports, submittal procedures, and project documentation.

C. See Section 01 5000 for additional requirements related to trash/waste collection and removal facilities and services.

D. See Section 01 6000 for waste prevention requirements related to delivery, storage, and handling.

E. See Section 01 7000 for trash/waste prevention procedures related to demolition, cutting and patching, installation, protection, and cleaning.

3.02 WASTE MANAGEMENT PLAN IMPLEMENTATION

A. Manager: Designate an on-site person or persons responsible for instructing workers and overseeing and documenting results of the Waste Management Plan.

B. Communication: Distribute copies of the Waste Management Plan to job site foreman, each subcontractor, Owner, Owner's Recycling and Solid Waste Coordinator, and Design Agent.

C. Instruction: Provide on-site instruction of appropriate separation, handling, and recycling, salvage, reuse, and return methods to be used by all parties at the appropriate stages of the project.

D. Meetings: Discuss trash/waste management goals and issues at project meetings.
1. Pre-bid meeting.
2. Pre-construction meeting.
3. Regular job-site meetings.

E. Facilities: Provide specific facilities for separation and storage of materials for recycling, salvage, reuse, return, and trash disposal, for use by all contractors and installers.
1. Provide containers as required.
2. Provide adequate space for pick-up and delivery and convenience to subcontractors.
3. Keep recycling and trash/waste bin areas neat and clean and clearly marked in order to avoid contamination of materials.

F. Hazardous Wastes: Separate, store, and dispose of hazardous wastes according to applicable regulations.

G. Recycling: Separate, store, protect, and handle at the site identified recyclable waste products in order to prevent contamination of materials and to maximize recyclability of identified materials. Arrange for timely pickups from the site or deliveries to recycling facility in order to prevent contamination of recyclable materials.

H. Reuse of Materials On-Site: Set aside, sort, and protect separated products in preparation for reuse.

I. Salvage: Set aside, sort, and protect products to be salvaged for reuse off-site.

END OF SECTION

01 7330 WASTE MANAGEMENT - Attachment A

A. The following amendments are made to this Section in order to facilitate execution of smaller projects at URI. They apply to the work of this project. All portions of the specification Section not deleted or amended remain in full force and effect for this project.

B. Delete paragraphs 1.01 F and 1.04 B. Change heading at 3.02 to be "WASTE MANAGEMENT PROCEDURES. Delete paragraphs 3.02 A, B and D. No Waste Management Plan will be required.

C. Delete lines 1.04 C.4c, .4d, .5c, .5d and .6c. Required back-up is reduced.

END OF ATTACHMENT

SECTION 01 7800 - CLOSEOUT REQUIREMENTS

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Closeout procedures.

B. Quality assurance.

C. Maintenance service.

D. Operations and maintenance manuals.

E. Materials and finishes manuals.

F. Equipment and systems manuals.

G. Spare parts and maintenance materials.

H. Product warranties and product bonds.

I. Project Record documents.

1.02 CLOSEOUT PROCEDURES

A. Submit a written certification that the Contract Documents have been reviewed, the Work has been inspected, and that the Work is complete in accordance with the Contract Documents and is ready for the Owner's review.

B. Provide submittals to Design Agent that are required by governing or other authorities, including
abatement invoices correctly prepared as proscribed in the abatement plan. Failure to include correctly prepared abatement invoices will delay issuing of final payment.

C. Provide submittals to Design Agent that are required by the governing or other authorities, including
the following closeout documents:
1. AIA Document G706 - Contractor's Affidavit of Payment of Debts and Claims
2. AIA Document G706A - Contractor's Affidavit of Release of Liens
3. AIA Document G707 - Consent of Surety to Final payment

D. Submit final Application for Payment identifying total adjusted Contract Sum, previous payments, and sum remaining due.

E. The Owner will occupy all portions of the building after Substantial Completion as specified in Section 01 1000.

1.03 QUALITY ASSURANCE

A. Employ personnel assembling submittals experienced in the maintenance and the operation of the described products and systems.

1.04 MAINTENANCE SERVICE

A. Submit a contract for furnishing service and maintenance of the components indicated in the specification Sections for one year from date of Substantial Completion, or during the warranty period, whichever period of time is the longest.

B. Provide for an examination of the system components at a frequency consistent with reliable operation. Clean, adjust, and lubricate as required.

C. Include a systematic cleaning, examination, adjustment, and lubrication of the components. Repair or replace the parts whenever required. Use the parts produced by the manufacturer of the original component.

D. Do not assign or transfer the maintenance service to an agent or Subcontractor without the prior written consent of the Owner.

1.05 OWNER'S MANUALS

A. Submit the data for Operations and Maintenance, Materials and Finishes, and Equipment and Systems Manuals bound in 8-1/2 x 11 inch text pages, in minimum 2 inch size three D side ring commercial quality binders with durable cleanable plastic covers.

B. Prepare binder covers with the printed title of the manual, title of the project, and the subject matter of binder. Label each spine with the following: Building, project or facility name, OCP project number, submission date.

C. Internally subdivide the binder contents with permanent page dividers, logically organized as described below; with tab titling clearly printed under reinforced laminated plastic tabs.

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

E. Submit two copies of a preliminary draft of the proposed formats and outline of the contents before the start of work. The Design Agent and its consultants will review drafts and return one copy with comments.

F. Submit one copy of the completed volumes 15 days prior to final inspection for final review. This copy will be reviewed and returned after final inspection, with the Design Agent's comments. Revise the content of the document sets as required prior to final submission.

G. Submit three sets of revised final volumes plus electronic copy in final form within ten days after final inspection.

1.06 OPERATIONS AND MAINTENANCE MANUALS

A. Contents: Prepare the Table of Contents for each volume, with each product or system description identified, in three parts as follows:
   1. **Part 1:** Directory, listing the names, addresses, and telephone numbers of the Design Agent, its Consultants, Contractor, Subcontractors, and major equipment suppliers.
   2. **Part 2:** Operation and maintenance instructions, arranged by system and subdivided by the specification Section. For each category, identify the names, addresses, and telephone numbers of the Subcontractors and suppliers. Identify the following:
      a. Significant design criteria.
      b. List of equipment.
      c. Parts list for each component.
      d. Operating instructions.
      e. Maintenance instructions for equipment and systems.
      f. Maintenance instructions for [special] finishes, including recommended cleaning methods and materials, and special precautions identifying detrimental agents.
   3. **Part 3:** Project documents and certificates, including the following:
      a. Shop drawings and product data.
      b. Air and water balance reports.
      c. Certificates.
      d. Originals of warranties and bonds.
   4. **Part 4:** Scan entire manual and provide 3 copies on disc in electronic PDF format.

1.07 MATERIALS AND FINISHES MANUALS

A. Building Products, Applied Materials, and Finishes: Include product data, with the catalog number, size, composition, and the color and texture designations. Include information for re-ordering custom manufactured products.

B. Instruction for Care and Maintenance: include manufacturer's instructions for cleaning agents and methods, precautions against detrimental agents and methods, and a recommended schedule for cleaning and maintenance.

C. Moisture Protection and Weather Exposed Products: Include product data listing applicable reference standards, chemical composition, and details of installation. Include recommendations for inspections, maintenance, and repair.

D. Additional Requirements: As specified in the individual product specification Sections.

E. Include a listing in the Table of Contents for design data, with a tabbed flysheet and a space for the insertion of data.

1.08 EQUIPMENT AND SYSTEMS MANUALS

A. For equipment, or component parts of equipment put into service during construction and operated by the Owner, submit documents within 10 days after acceptance.

B. Each Item of Equipment and Each System: Include a description of the unit or system, and the component parts. Identify the function, normal operating characteristics, and limiting conditions. Include performance curves, with priming data and tests, and complete nomenclature and model number of replaceable parts.

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, shutdown, and emergency instructions. Include summer, winter, and special operating instructions.

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

G. Include a servicing and lubricating schedule, and a list of lubricants required.

H. Include the manufacturer's printed operation and maintenance instructions.

I. Include sequence of operation by the controls manufacturer.

J. Include the original manufacturer's parts list, illustrations, assembly drawings, and diagrams required for maintenance.

K. Include control diagrams by the controls manufacturer as installed.

L. Include the Contractor's coordination drawings, with color-coded piping diagrams as installed.

M. Include charts of valve tag numbers, with the location and function of each valve, keyed to the flow and control diagrams.

N. Include a list of the original manufacturer's spare parts, current prices, and recommended quantities to be maintained in storage.

O. Include test and balancing reports as specified in Section 01400.

P. Additional Requirements: As specified in the individual product specification Sections.

1.09 SPARE PARTS AND MAINTENANCE PRODUCTS

A. Furnish spare parts, maintenance, and extra products (attic stock) in the quantities specified in the individual specification Sections.

B. Deliver to the Project site and place in a location as directed by the Owner; obtain a receipt prior to final payment.

1.10 PRODUCT WARRANTIES AND PRODUCT BONDS

A. Obtain warranties and bonds executed in duplicate by the responsible subcontractors, suppliers, and manufacturers, within 10 days after the completion of the applicable item of work.

B. Execute and assemble the transferable warranty documents and bonds from the subcontractors, suppliers, and manufacturers.

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

D. Co-execute the submittals when required.

E. Include in the Operations and Maintenance Manuals within the appropriate material specification section.

F. Submit prior to the final Application for Payment. For items of Work for which acceptance is delayed beyond the Date of Substantial Completion, submit within 10 days after acceptance, listing the date of acceptance as the beginning of the warranty or bond period.

1.11 PROJECT RECORD DOCUMENTS

A. Maintain on the site one set of the following record documents; record actual revisions of the Work for all trades:
   1. Drawings.
   2. Specifications.
   3. Addenda.
   4. Change Orders and other modifications to the Contract.
   5. Reviewed Shop Drawings, Product Data, and Samples.
   6. Manufacturer's instructions for assembly, installation, and adjusting.

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

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

D. Record information concurrent with the construction progress, not less than weekly.

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

F. Record Drawings and Shop Drawings: Legibly mark each item to record the actual construction including:
   1. Measured horizontal and vertical locations of the underground utilities and appurtenances, referenced to permanent surface improvements. Include the locations and description of any existing utility lines and other existing installations of any kind or description encountered during construction. Note all changes in size, material, location, and elevation of all new or abandoned underground utility lines and pertinent work, including site grading. Document topography and drainage changes. Show the location of all valves, manholes, etc. and include dimensions to permanent features such as building corners. Note direction of each new valve opening. Show clearances between new utilities and existing crossed lines. Locate all bends, thrust blocks, and other restraints.
   2. The placement, size, and type of any fire extinguishers.
   3. Measured locations of internal utilities and appurtenances concealed in the construction.
   4. Field changes of dimension and detail.
   5. Details not on the original Contract drawings.

G. Legibly marked Specifications, and legibly marked Record Drawings and Shop Drawings shall constitute the Project Record Documents in paper form.

H. At completion of the Work of the Contract, the Contractor shall retain competent drafting personnel to transfer the information from the Project Record Documents in paper form to editable electronic formats to create “As-Built” Documents on base files provided by the Design Agent. The record construction drawings shall be produced in both AutoCAD format plus a record PDF copy of each drawing. AutoCAD files shall include all XREF, font, image, shape, and plot files. PDF files shall be saved full sheet size. The record Project Manual shall be in Microsoft Word form plus a record PDF of the entire manual. The electronic media containing this information will constitute the Project Record Documents in digital form, sometimes referred to as the “As-Built” Documents. Acceptable media are write-protected CD-R format discs or flash drives. Submit one full size printed set of drawings and specifications on 20 lb. white bond made from the As-Built files in addition to the electronic media.

I. Associated materials including but not limited to the following are also required to be submitted at project close-out: shop drawings and cut sheets, RFIs, correspondence and meeting minutes, LEED scorecards, construction progress photographs, DEM permits including generator permits, certificates including Final Certificate of Occupancy, boiler and elevator certificates, easement rights, National Grid Rebate Applications, test and inspection documentation including fire pump test data, asbestos abatement plans and manifests. These materials may be

submitted in either paper or PDF digital format, organized by specification number, and clearly labeled. If paper copies are submitted, each box must be clearly labeled as to specific contents.

J. If the project required geotechnical, archeological, or other miscellaneous studies or other reports, these shall also be submitted as Record Document in either paper or digital format.

K. Labeling: In all cases, paper or digital submissions must contain the following information: Building, project or facility name, OCP Project number, submission date, and specific content index.

L. No review or receipt of Project Record Documents by the Design Agent or the Owner shall be interpreted as a waiver of any deviation from the Contract Documents or Shop Drawings, or in any way relieve the Contractor from responsibility to perform the Work in accordance with the Contract Documents and the Shop Drawings.

M. Update the on-site Project Record Documents on a regular basis. Monthly payments will not be processed if Project Record Documents are not maintained up to date.

PART 2 - PRODUCTS

Not used.

PART 3 - EXECUTION

Not used.

END OF SECTION

01 7810 CLOSEOUT REQUIREMENTS - Attachment A

Small Project Changes

A. The following amendments are made to this Section in order to facilitate execution of smaller projects at URI. They apply to the work of this project. All portions of the specification Section not deleted or amended remain in full force and effect for this project.

B. Delete subparagraph 1.02 A. Additional certification is not required.

C. Delete lines1.02 C.1 and 3. Only the final release of liens remains as a requirement from this paragraph.

D. Delete paragraph 1.03. General knowledge of construction is sufficient.

E. Delete subparagraph 1.05 E. No preliminary submittal is required.

F. In subparagraph 1.11 F, end the first sentence after “construction”, and delete the lines 1 thru 5. Record changes to the work as clearly as possible to facilitate future work.

END OF ATTACHMENT

SECTION 02 4100
SELECTIVE DEMOLITION

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Selective demolition of building elements for alteration purposes.

B. Abandonment and removal of existing utilities and utility structures.

1.02 RELATED REQUIREMENTS

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

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

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

1.03 SUBMITTALS

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

B. Project Record Documents: Accurately record actual locations of capped and active utilities and subsurface construction.

PART 2 PRODUCTS

PART 3 EXECUTION

3.01 SCOPE

A. Remove items as required for new work or in accordance with codes or specifications, including transfer grill, obsolete mechanical equipment, obsolete wiring and devices, light fixtures, surface conduit and boxes, and other items indicated,

3.02 GENERAL PROCEDURES AND PROJECT CONDITIONS

A. Comply with applicable codes and regulations for demolition operations and safety of adjacent structures and the public.
   1. Obtain required permits.
   2. Conduct operations to minimize effects on and interference with adjacent structures and occupants.
   3. Conduct operations to minimize obstruction of public and private entrances and exits; do not obstruct required exits at any time; protect persons using entrances and exits from removal operations.

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

C. Protect existing structures and other elements that are not to be removed.

D. If hazardous materials are discovered during removal operations, stop work and notify Architect and Owner; hazardous materials include regulated asbestos containing materials, lead, PCB's, and mercury.

E. Perform demolition in a manner that maximizes salvage and recycling of materials.
   1. Dismantle existing construction and separate materials.
   2. Set aside reusable, recyclable, and salvageable materials; store and deliver to collection point or point of reuse.

3.03 EXISTING UTILITIES

A. Protect existing utilities to remain from damage.

B. Do not close, shut off, or disrupt existing life safety systems that are in use without 48 hours prior written notification to Owner.

C. Do not close, shut off, or disrupt existing utility branches or take-offs that are in use without 48 hours prior written notification to Owner.

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

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

3.04 SELECTIVE DEMOLITION FOR ALTERATIONS

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

B. Separate areas in which demolition is being conducted from other areas that are still occupied.

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

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

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

3.05 DEBRIS AND WASTE REMOVAL

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

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

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

END OF SECTION

SECTION 06 1000
ROUGH CARPENTRY

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Concealed wood blocking, nailers, and supports.

1.02 RELATED REQUIREMENTS

A. Section 09 2116 - Gypsum Board Assemblies: Gypsum-based sheathing.

1.03 REFERENCE STANDARDS

A. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2016.

B. AWPA U1 - Use Category System: User Specification for Treated Wood; 2012.

C. PS 1 - Structural Plywood; 2009.

D. PS 20 - American Softwood Lumber Standard; 2010.

1.04 SUBMITTALS

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

1.05 DELIVERY, STORAGE, AND HANDLING

A. General: Cover wood products to protect against moisture. Support stacked products to prevent deformation and to allow air circulation.

1.06 WARRANTY

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

PART 2 PRODUCTS

2.01 GENERAL REQUIREMENTS

A. Dimension Lumber: Comply with PS 20 and requirements of specified grading agencies.
   1. Species: Douglas Fir, unless otherwise indicated.
   2. If no species is specified, provide any species graded by the agency specified; if no grading agency is specified, provide lumber graded by any grading agency meeting the specified requirements.
   3. Grading Agency: Any grading agency whose rules are approved by the Board of Review, American Lumber Standard Committee (www.alsc.org) and who provides grading service for the species and grade specified; provide lumber stamped with grade mark unless otherwise indicated.

B. Lumber fabricated from old growth timber is not permitted.

2.02 DIMENSION LUMBER FOR CONCEALED APPLICATIONS

A. Sizes: Nominal sizes as indicated on drawings, S4S.

B. Moisture Content: S-dry or MC19.

C. Miscellaneous Framing, Blocking, Nailers, Grounds, and Furring:
   1. Lumber: S4S, No. 2 or Standard Grade.
   2. Boards: Standard or No. 3.

2.03 CONSTRUCTION PANELS

A. Communications and Electrical Room Mounting Boards: PS 1 A-D plywood, or medium density fiberboard; 3/4 inch (19 mm) thick; flame spread index of 25 or less, smoke developed index of 450 or less, when tested in accordance with ASTM E84.

2.04 FACTORY WOOD TREATMENT

A. Treated Lumber and Plywood: Comply with requirements of AWPA U1 - Use Category System for wood treatments determined by use categories, expected service conditions, and specific applications.
   1. Fire-Retardant Treated Wood: Mark each piece of wood with producer's stamp indicating compliance with specified requirements.

PART 3 EXECUTION

3.01 PREPARATION

A. Coordinate installation of rough carpentry members specified in other sections.

3.02 INSTALLATION - GENERAL

A. Select material sizes to minimize waste.

B. Reuse scrap to the greatest extent possible; clearly separate scrap for use on site as accessory components, including: shims, bracing, and blocking.

C. Where treated wood is used on interior, provide temporary ventilation during and immediately after installation sufficient to remove indoor air contaminants.

3.03 BLOCKING, NAILERS, AND SUPPORTS

A. Provide framing and blocking members as indicated or as required to support finishes, fixtures, specialty items, and trim.

B. In walls, provide blocking attached to studs as backing and support for wall-mounted items, unless item can be securely fastened to two or more studs or other method of support is explicitly indicated.

C. Provide the following specific non-structural framing and blocking:
   1. Wall-mounted door stops.
   2. White boards.
   3. Lockers.
   4. LED Monitors, large screen monitors.

3.04 INSTALLATION OF CONSTRUCTION PANELS

A. Monitor Mounting Boards: Secure with screws to studs with edges over firm bearing; space fasteners at maximum 24 inches (610 mm) on center on all edges and into studs in field of board.

END OF SECTION

SECTION 06 41 00
ARCHITECTURAL WOOD CASEWORK

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Cabinets.

B. Bookshelves.

C. Countertops.

1.02 RELATED REQUIREMENTS

A. Section 06 1000 - Rough Carpentry: Support framing, grounds, and concealed blocking.

1.03 REFERENCE STANDARDS

A. ANSI A208.2 - American National Standard for Medium Density Fiberboard for Interior Use; 2009.

B. AWI (QCP) - Quality Certification Program, www.awiqcp.org; current edition at www.awiqcp.org.

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

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

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

F. PS 1 - Structural Plywood; 2009.

1.04 SUBMITTALS

A. See Section 01 3300 - Submittal Procedures, for submittal procedures.

B. Shop Drawings: Indicate materials, component profiles, fastening methods, jointing details, and accessories.
   1. Minimum Scale of Detail Drawings: 1-1/2 inch to 1 foot (1:8).
   2. Provide the information required by AWI/AWMAC/WI Architectural Woodwork Standards.
   3. Include certification program label.

C. Product Data: Provide data for hardware accessories.

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

E. Samples: Submit actual sample items of proposed pulls, hinges, shelf standards, and locksets, demonstrating hardware design, quality, and finish.

1.05 QUALITY ASSURANCE

A. Fabricator Qualifications: Company specializing in fabricating the products specified in this section with minimum five years of documented experience.
   1. Accredited participant in the specified certification program prior to the commencement of fabrication and throughout the duration of the project.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Protect units from moisture damage.

B. Provide temporary protective covers for items during delivery, installation, and until final acceptance of Project.

1.07 FIELD CONDITIONS

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

B. Verify that field measurements are as indicated on Shop Drawings.

PART 2 PRODUCTS

2.01 CABINETS

A. Quality Grade: Unless otherwise indicated provide products of quality specified by AWI//AWMAC/WI Architectural Woodwork Standards for Premium Grade.

B. Painted Cabinets:

1. Surfaces and core: Painted Solid Maple
2. Fasteners and Accessories: Provide the required anchors, plates, clips, screws and accessories for a concealed fastening system and as required for a complete and finished installation.

C. Plastic Laminate Panels:

1. Surfaces: Plastic laminate surface of exposed faces, edges and backs of cabinet doors with high pressure laminate materials conforming to NEMA LD3. Plastic laminate material shall be solid color throughout the thickness of the material. Cabinet interiors to have white melamine.
2. Core: The core shall be plywood, close grained hardwood faced plywood, not less than 5-ply and graded not less than B-B, with both sides sanded.
3. Backing Sheet: Backing sheet shall be not less than .020 inch balancing sheet plastic laminate. All laminated plastic laminated boards shall have backing sheets.
4. Adhesive: Type I waterproof glue manufactured for veneering plastic laminate to core material.
5. Fasteners and Accessories: Provide the required anchors, plates, clips, screws and accessories for a concealed fastening system and as required for a complete and finished installation.

C. Finish Cabinet Hardware:

1. Provide finish hardware for cabinets as required to complete the work whether specified or not.
2. Each cabinet door shall be provided with appropriate hinges, pull, catches and stops. Include key operated locks.
3. Finish: The finish of all hardware shall be US32D or US26D.

2.02 WOOD-BASED COMPONENTS

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

2.03 LAMINATE MATERIALS

A. Manufacturers:

1. Formica Corporation: www.formica.com.
2. Lamin-Art, Inc.: www.laminart.com.
3. Wilsonart International, Inc: www.wilsonart.com.

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

2.04 ACCESSORIES

A. Adhesive: Type recommended by fabricator to suit application.

B. Fasteners: Size and type to suit application.

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

D. Concealed Joint Fasteners: Threaded steel.

E. Grommets: Standard plastic, painted metal, or rubber grommets for cut-outs, in color to match adjacent surface.

2.05 HARDWARE

A. Adjustable Shelf Supports: Standard side-mounted system using recessed metal shelf standards or multiple holes for pin supports and coordinated self rests, polished chrome finish, for nominal 1 inch (25 mm) spacing adjustments.

B. Door Pulls: Baldwin, Severin Fayerman Appliance Pull, Model #4358.150.

C. Hinges: Heavy Duty European style concealed self-closing type, steel with polished finish.

D. Door Lock: Heavy Duty cabinet locks by Haefele or equal.

2.06 GRAPHICS

C. Graphics:
1. Provide lettering and logo for signage on walls as indicated on drawings.
2. Sandblast or etch graphics or provide vinyl decals. If vinyl, color to be selected by architect.

PART 3 EXECUTION

3.01 FABRICATION

A. Assembly: Shop assemble cabinets for delivery to site in units easily handled and to permit passage through building openings.

B. Edging: Fit shelves, doors, and exposed edges with specified edging. Do not use more than one piece for any single length.

C. Fitting: When necessary to cut and fit on site, provide materials with ample allowance for cutting. Provide matching trim for scribing and site cutting.

D. Plastic Laminate: Apply plastic laminate finish in full uninterrupted sheets consistent with manufactured sizes. Fit corners and joints hairline; secure with concealed fasteners. Slightly bevel arises. Locate counter butt joints minimum 2 feet (600 mm) from sink cut-outs.
1. Apply laminate backing sheet to reverse side of plastic laminate finished surfaces.

E. Provide cutouts for plumbing fixtures. Verify locations of cutouts from on-site dimensions. Prime paint cut edges.

3.02 EXAMINATION

A. Verify adequacy of backing and support framing.

B. Verify location and sizes of utility rough-in associated with work of this section.

3.03 INSTALLATION

A. Set and secure custom cabinets in place, assuring that they are rigid, plumb, and level.

B. Use fixture attachments in concealed locations for wall mounted components.

C. Use concealed joint fasteners to align and secure adjoining cabinet units.

D. Carefully scribe casework abutting other components, with maximum gaps of 1/32 inch (1 mm). Do not use additional overlay trim for this purpose.

E. Secure cabinets to floor using appropriate angles and anchorages.

F. Countersink anchorage devices at exposed locations. Conceal with solid wood plugs of species to match surrounding wood; finish flush with surrounding surfaces.

3.04 ADJUSTING

A. Adjust installed work.

B. Adjust moving or operating parts to function smoothly and correctly.

3.05 CLEANING

A. Clean casework, counters, shelves, hardware, fittings, and fixtures.

3.06 SCHEDULE

A. Cabinets

1. Kraftmaid Painted Cabinets Gray

B. Laminate

1. PL-1	Wilsonart	Matte Finish	Fusion Maple 7909-60

END OF SECTION

SECTION 07 9200
JOINT SEALANTS

PART 1 GENERAL

2.01 SECTION INCLUDES

A. Nonsag gunnable joint sealants.

B. Joint backings and accessories.

2.02 RELATED REQUIREMENTS

A. Section 01 6116 - Volatile Organic Compound (VOC) Content Restrictions: Additional requirements for sealants and primers.

B. Section 09 2116 - Gypsum Board Assemblies: Sealing acoustical and sound-rated walls and ceilings.

2.03 REFERENCE STANDARDS

A. ASTM C834 - Standard Specification for Latex Sealants; 2010.

B. ASTM C920 - Standard Specification for Elastomeric Joint Sealants; 2014.

C. ASTM C1193 - Standard Guide for Use of Joint Sealants; 2016.

2.04 SUBMITTALS

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

B. Product Data for Sealants: Submit manufacturer's technical data sheets for each product to be used, that includes the following.
   1. Physical characteristics, including movement capability, VOC content, hardness, cure time, and color availability.
   2. List of backing materials approved for use with the specific product.
   3. Substrates that product is known to satisfactorily adhere to and with which it is compatible.
   4. Substrates the product should not be used on.

C. Color Cards for Selection: Where sealant color is not specified, submit manufacturer's color cards showing standard colors available for selection.

2.05 WARRANTY

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

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

C. Warranty: Include coverage for installed sealants and accessories that fail to achieve watertight seal , exhibit loss of adhesion or cohesion, or do not cure.

PART 2 PRODUCTS

3.01 MANUFACTURERS

A. Non-Sag Sealants: Permits application in joints on vertical surfaces without sagging or slumping.
   1. Dow Corning Corporation: www.dowcorning.com/construction/sle.
   2. Pecora Corporation; _____: www.pecora.com/?sle.
   3. Tremco Global Sealants; _____: www.tremcosealants.com.

3.02 JOINT SEALANT APPLICATIONS

A. Scope:
   1. Interior Joints: Do not seal interior joints unless specifically indicated to be sealed. Interior joints to be sealed include, but are not limited to, the following items.
      a. Joints between door, window, and other frames and adjacent construction.
      b. Other joints indicated below.
   2. Do not seal the following types of joints.

a. Joints indicated to be treated with manufactured expansion joint cover or some other type of sealing device.
b. Joints where sealant is specified to be provided by manufacturer of product to be sealed.
c. Joints where installation of sealant is specified in another section.
d. Joints between suspended panel ceilings/grid and walls.

B. Interior Joints: Use non-sag polyurethane sealant, unless otherwise indicated.
1. Wall and Ceiling Joints in Non-Wet Areas: Acrylic emulsion latex sealant.

3.03 JOINT SEALANTS - GENERAL

A. Sealants and Primers: Provide products with levels of volatile organic compound (VOC) content as indicated in Section 01 6116.

3.04 NONSAG JOINT SEALANTS

A. Silicone Sealant: ASTM C920, Grade NS, Uses M and A; not expected to withstand continuous water immersion or traffic.
1. Movement Capability: Plus and minus 25 percent, minimum.
2. Color: To be selected by Architect from manufacturer's standard range.

B. Acrylic Emulsion Latex: Water-based; ASTM C834, single component, non-staining, non-bleeding, non-sagging; not intended for exterior use.
1. Color: To be selected by Architect from manufacturer's standard range.

3.05 ACCESSORIES

A. Backer Rod: Cylindrical cellular foam rod with surface that sealant will not adhere to, compatible with specific sealant used, and recommended by backing and sealant manufacturers for specific application.

B. Backing Tape: Self-adhesive polyethylene tape with surface that sealant will not adhere to and recommended by tape and sealant manufacturers for specific application.

PART 3 EXECUTION

4.01 EXAMINATION

A. Verify that joints are ready to receive work.

B. Verify that backing materials are compatible with sealants.

C. Verify that backer rods are of the correct size.

4.02 PREPARATION

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

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

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

D. Mask elements and surfaces adjacent to joints from damage and disfigurement due to sealant work; be aware that sealant drips and smears may not be completely removable.

4.03 INSTALLATION

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

B. Perform installation in accordance with ASTM C1193.

C. Install bond breaker backing tape where backer rod cannot be used.

D. Install sealant free of air pockets, foreign embedded matter, ridges, and sags, and without getting sealant on adjacent surfaces.

E. Do not install sealant when ambient temperature is outside manufacturer's recommended temperature range, or will be outside that range during the entire curing period, unless manufacturer's approval is obtained and instructions are followed.

F. Nonsag Sealants: Tool surface concave, unless otherwise indicated; remove masking tape immediately after tooling sealant surface.

END OF SECTION

SECTION 08 1113

HOLLOW METAL DOORS AND FRAMES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Non-fire-rated steel doors and frames.

B. Fire-rated steel doors and frames.

1.02 RELATED REQUIREMENTS

A. Section 08 7100 - Door Hardware.

B. Section 09 9000 - Painting and Coating: Field painting.

1.03 REFERENCE STANDARDS

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

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

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

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

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

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

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

H. UL 10C - Standard for Positive Pressure Fire Tests of Door Assemblies; Current Edition, Including All Revisions.

1.04 SUBMITTALS

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

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

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

1.05 QUALITY ASSURANCE

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

B. Maintain at the project site a copy of all reference standards dealing with installation.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Store in accordance with NAAMM HMMA 840.

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

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Steel Doors and Frames:

1. Assa Abloy Ceco, Curries, or Fleming: www.assaabloydss.com.
2. Republic Doors: www.republicdoor.com.
3. Steelcraft, an Allegion brand: www.allegion.com/us.
4. HMF Express: www.hmfexpress.com

A. Manufacturer Glazing Material: "Pilkington Pyrostop®" fire-rated glazing as manufactured by the Pilkington Group and distributed by Technical Glass Products, 8107 Bracken Place SE, Snoqualmie, WA 98065 phone (800.426.0279) fax (425.396.8300) e-mail sales@fireglass.com, web site http://www.fireglass.com

B. Frame System: "Fireframes® Heat Barrier Series" fire-rated [steel] frame system as manufactured and supplied by Technical Glass Products, 8107 Bracken Place SE, Snoqualmie, WA 98065 phone (800.426.0279) fax (425.396.8300) e-mail sales@fireglass.com web site http://www.fireglass.com

2.02 DOORS AND FRAMES

A. Requirements for All Doors and Frames:

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

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

2.03 STEEL DOORS

A. Steelcraft L Series, or equal

B. 16 gauge

2.04 STEEL FRAMES

A. General:

1. Comply with the requirements of grade specified for corresponding door.

a. ANSI A250.8 Level 1 Doors: 16 gage frames.

2. Finish: Same as for door.

3. Frames Wider than 48 Inches (1200 mm): Reinforce with steel channel fitted tightly into frame head, flush with top.

2.05 ACCESSORY MATERIALS

A. Glazing: As specified in Section 08 8000.

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

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

2.06 FINISH MATERIALS

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

B. Bituminous Coating: Asphalt emulsion or other high-build, water resistant, resilient coating.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify existing conditions before starting work.

B. Verify that opening sizes and tolerances are acceptable.

3.02 PREPERATION

A. Coat the inside of frames to be installed in masonry or grouted, with bituminous coating, prior to installation..

3.03 INSTALLATION

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

B. In addition, install fire rated units in accordance with NFPA 80.

C. Coordinate frame anchor placement with wall construction.

D. Coordinate installation of hardware.

E. Paint all new metal doors and frames.

1. Factory prime

2. Shop finish coat paint

3. Color: Match existing color

F. Existing metal frames at interior are to remain, unless otherwise noted.

3.03 TOLERANCES

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

3.04 ADJUSTING

A. Adjust for smooth and balanced door movement.

END OF SECTION

SECTION 08 41 23

FIRE RATED

STEEL FRAMED ENTRANCES

PART 1 GENERAL

1.1 SUMMARY

A. Section includes:
   1. Fire rated glazing and framing systems for installation as full vision fire rated doors in interior openings.

B. Related Sections:
   1. Section 08 11 13 “Hollow Metal Doors and Frames.” Hollow Metal doors prepped for the work of this section.
   2. Section 08 71 00 “Door Hardware:” Door hardware other than that provided by the work of this section
   3. Section 08 71 13 “Automatic Door Operators” opener for door to comply with ADA and Local Authority opening force requirements.

1.2 REFERENCES

A. American Architectural Manufacturers Association (AAMA):
   1. AAMA 2603-2002 - Voluntary Specification, Performance Requirements and Test Procedures for Pigmented Organic Coatings on Aluminum Extrusions and Panels.
   2. AAMA 2604-2005 - Voluntary Specification, Performance Requirements and Test Procedures for High Performance Organic Coatings on Aluminum Extrusions and Panels.
   3. AAMA 2605-2005 - Voluntary Specification, Performance Requirements and Test Procedures for Superior Performing Organic Coatings on Aluminum Extrusions and Panels.

B. American Society for Testing and Materials (ASTM):
   1. Fire safety related:
      a. ASTM E119: Methods for Fire Tests of Building Construction and Materials.
   2. Material related
      a. ASTM A 1008/A 1008M - Standard Specification for Steel, Sheet, Cold-Rolled, Carbon, Structural, High-Strength, Low Alloy, and High-Strength Low-Alloy with Improved Formability, Solution Hardened, and Bake Hardenable; 2007.
      b. ASTM A 1011/A 1011M - Standard Specification for Steel, Sheet and Strip, Hot-Rolled, Carbon, Structural, High-Strength Low-Alloy and High-Strength Low-Alloy with Improved Formability, and Ultra-High Strength; 2006b.
      c.
      d. ASTM E 413-04: Standard Classification for Rating Sound Insulation

C. American Welding Society (AWS)

   1. AWS D1.3 - Structural Welding Code - Sheet Steel; 2007

D. Builders Hardware Manufacturers Association, Inc

1. BHMA A156 - American National Standards for door hardware; 2006 (ANSI/BHMA A156).

E. National Fire Protection Association (NFPA):
1. NFPA 80: Standard for Fire Doors and Windows.
2. NFPA 251: Standard of Methods of Fire Tests of Building Construction & Materials
3. NFPA 252: Standard of Methods of Fire Tests of Door Assemblies

F. Underwriters Laboratories, Inc. (UL):
1. UL 10 B: Fire Tests of Door Assemblies
2. UL 10 C: Positive Pressure Fire Tests of Window & Door Assemblies
3. UL 263: Fire tests of Building Construction and Materials

G. American National Standards Institute (ANSI):
1. ANSI Z97.1: Standard for Safety Glazing Materials Used in Buildings

1.3 DEFINITIONS

A. Manufacturer: A firm that produces primary glass, fabricated glass or framing as defined in referenced glazing publications.

1.4 SUBMITTALS

A. Submit in accordance with Section 01 3300 SUBMITTAL PROCEDURES

B. Product Data:
1. Technical Information: Submit latest edition of manufacturer's product data providing product descriptions, technical data, Underwriters Laboratories, Inc. listings and installation instructions.

C. Shop Drawings:
1. Include plans, elevations and details of product showing component dimensions; framed opening requirements, dimensions, tolerances, and attachment to structure.

D. Hardware schedule: list of manufacture supplied hardware and verification of cylinder size complying with Section 08 71 00

E. Samples (optional): For following products:
1. Glass sample-as provided by manufacturer
2. Sample of frame
3. Verification of sample of selected finish

F. Glazing Schedule: Use same designations indicated on drawings for glazed openings in preparing a schedule listing glass types and thicknesses for each size opening and location.

G. Warranties: Submit manufacturer's warranty.

H. Certificates of compliance from glass and glazing materials manufacturers attesting that glass and glazing materials furnished for project comply with requirements.
1. Separate certification will not be required for glazing materials bearing manufacturer's permanent label designating type and thickness of glass, provided labels represent a quality control program involving a recognized certification agency or independent testing laboratory acceptable to authority having jurisdiction.

1.5 QUALITY ASSURANCE

A. Testing Agency Qualifications: Qualified according to
   1. International Accreditation Service for a Type A Third-Party Inspection Body (Field Services ICC-ES Third-Party Inspections Standard Operating Procedures, 00-BL-S0400 and S0401)
   2. International Accreditation Service for Testing Body-Building Materials and Systems
      a. Fire Testing
         1) ASTM Standards E 119
         2) CPSC Standards 16 CFR 1201
         3) NFPA Standards 251, 252, 257
         4) UL Standards 9, 10B, 10C, 1784, UL Subject 63
         5) BS 476; Part 22: 1987
         6) EN 1634-1

B. Installer Qualifications: An experienced installer who has completed glazing similar in material, design, and extent to that indicated for Project and whose work has resulted in construction with a record of successful in-service performance.

C. Source Limitations for Glazing Accessories: Obtain glazing accessories from one source for each product and installation method indicated.

D. Fire-Rated Door Assemblies: Assemblies complying with NFPA 80 that are classified and labeled by UL, for fire ratings indicated, based on testing according to NFPA 252, ASTM E119. Assemblies must be factory-welded or come complete with factory-installed mechanical joints and must not require job site fabrication. 222v

E. Listings and Labels - Fire Rated Assemblies: Under current follow-up service by Underwriters Laboratories® maintaining a current listing or certification. Label assemblies accordance with limits of manufacturer's listing.

F. Regulatory Requirements: Comply with provisions of the following:
   1. Where indicated to comply with accessibility requirements, comply with **Americans with Disabilities Act (ADA), "Accessibility Guidelines for Buildings and Facilities (ADAAG)," ANSI A117.1,FED-STD-795, "Uniform Federal Accessibility Standards,"** as follows:
      a. Handles, Pulls, Latches, Locks, and other Operating Devices: Shape that is easy to grasp with one hand and does not require tight grasping, tight pinching, or twisting of the wrist.
   2. NFPA 101: Comply with the following for means of egress doors:
      a. Latches, Locks, and Exit Devices: Not more than 15 lbf (67 N) to release the latch. Locks shall not require the use of a key, tool, or special knowledge for operation.
      b. Door Closers: Not more than 30 lbf (133 N) to set door in motion and not more than 15 lbf (67 N) to open door to minimum required width.
   3. IBC 2012 Chapter 10 Means of Egress: Comply with the following for means of egress doors:
      a. Latches, Locks, and Exit Devices: Not more than 15 lbf (67 N) to release the latch. Locks shall not require the use of a key, tool, or special knowledge for operation.
      b. Door Closers: Not more than 30 lbf (133 N) to set door in motion and not more than 15 lbf (67 N) to open door to minimum required width.

1.6 DELIVERY, STORAGE AND HANDLING

A. Deliver, store and handle under provisions specified by manufacturer.

1.7 PROJECT CONDITIONS

A. Obtain field measurements prior to fabrication of frame units. If field measurements will not be available in a timely manner coordinate planned measurements with the work of other sections.
   1. Note whether field or planned dimensions were used in the creation of the shop drawings.

B. Coordinate the work of this section with others effected including but not limited to: other interior and/or exterior envelope components and door hardware beyond that provided by this section

1.8 WARRANTY

A. Provide the Pilkington Pyrostop® and the Fireframes® Heat Barrier Series standard five-year manufacturer warranty.

PART 2 - PRODUCTS

2.1 MANUFACTURERS - FIRE RATED [DOOR ASSEMBLY] [WINDOW] [WALL ASSEMBLY]

A. Manufacturer Glazing Material: "Pilkington Pyrostop®" fire-rated glazing as manufactured by the Pilkington Group and distributed by Technical Glass Products, 8107 Bracken Place SE, Snoqualmie, WA 98065 phone (800.426.0279) fax (425.396.8300) e-mail sales@fireglass.com, web site http://www.fireglass.com

B. Frame System: "Fireframes® Heat Barrier Series" fire-rated steel frame system as manufactured and supplied by Technical Glass Products, 8107 Bracken Place SE, Snoqualmie, WA 98065 phone (800.426.0279) fax (425.396.8300) e-mail sales@fireglass.com web site http://www.fireglass.com

C. Substitutions: Substitutions for Glazing Material and Frame System not permitted.

2.2 PERFORMANCE REQUIREMENTS

A. Fire Rating Requirements
   1. Duration -- Doors: Capable of providing a fire rating for 90 minutes.

B. Delegated design: For the performance requirements listed below requiring structural design provide data, calculations and drawings signed and sealed by an engineer licensed in the state [province] where the project is located.

C. Design Requirements
   1. Dimensions – Door and Framing:
      a. Door framing face dimension: 2-3/16-inch.
      b. Depth of door framing: 2-9/16-inch.
      c. Door style face dimension: 3-/11/16-inch.
      d. Door cross rail (if applicable) face: 4-1/8-inch.
      e. Depth of stile, header, sill and cross rail: 2-3/16-inch

   2. Construction: Narrow-profile, roll-formed steel architectural grade specialty fire doors. Conventional break-shape type hollow metal steel fire-rated doors will not be considered an acceptable substitute for the Fireframes Heat Barrier Series doors specified in this section as they do not conform to the project design intent and/or aesthetic and quality standards.
      a. Knock down frames are not permitted.

D. Properties Interior Glazing

Property	
Fire Rating	90 minute
Manufacturer's designation	90-102
Glazing type	single
Nominal Thickness	1-7/16" (37mm)
Weight in lbs/sf	17.61
Daylight Transmission	84%
Sound Transmission Coefficient	45dB

E. Logo: Each piece of fire-rated glazing shall be labeled with a permanent logo including name of product, manufacture, testing laboratory (UL), fire rating period, safety glazing standards, and date of manufacture.

F. Glazing Accessories: Manufacturer's standard compression gaskets, spacers, setting blocks and other accessories necessary for a complete installation.

2.3 MATERIALS – STEEL DOORS

A. Steel Door System 90 min:
1. Manufacturer's standard double leaf doors with manufacture's standard hardware
2. Coordinate door hardware with cylinder specified in Section 08 71 00 Hardware

2.4 FABRICATION
1. Knock-down door perimeter frames are not permitted

B. Field glaze door and frame assemblies.

C. Factory prepare steel door assemblies and install all hardware.

D. Fabrication Dimensions: Fabricate fire rated assembly to field dimensions.

E. Obtain approved Shop Drawings prior to fabrication.

2.5 FINISHES, GENERAL

A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

B. Appearance of Finished Work: Variations in appearance of abutting or adjacent pieces are acceptable. Noticeable variations in the same piece are not acceptable.

2.6 POWDERCOAT FINISHES

A. Finish after fabrication.

B. Appearance of Finished Work: Variations in appearance of abutting or adjacent pieces are acceptable. Noticeable variations in the same piece are not acceptable.

C. Interior and Exterior Steel Finishes (Note: this finish is suitable for exterior exposed portions of the wall systems, including extruded aluminum covers)
1. Powder-Coat Finish: Polyester Super Durable powder coating which meets AAMA 2604 for chalking and fading. Apply manufacturer's standard powder coating finish system applied to factory-assembled frames before shipping, complying with manufacturer's recommended instructions for surface preparation including pretreatment, application, and minimum dry film thickness.
2. Color and Gloss: As selected by Architect from manufacturer's full range.
3. Acceptable Manufacturers:
   a. Tiger Drylac
   b. Additional manufacturers as approved by TGP

2.7 DOOR HARDWARE FOR SINGLE AND PAIRED DOORS

A. Furnish hardware with 90 minute fire door by the manufacturer. Select hardware from door manufacturer's standard recommended and approved hardware groups as specified in Division 8 Section "Door Hardware".
1. All hardware BHMA Certified

B. Provide power assisted hardware for use at any door that cannot meet the opening force(s) required by code noted in Part I above.
1. High energy, power-operated doors must meet the requirements of ANSI/BHMA A156.10 and power-assisted low energy doors must comply with ANSI/BHMA 156.19.

C. Operating hardware for Fireframes® Heat Barrier Series **Active-Fixed Outswing Pair of Doors with Mortise Locking**. Each pair to have the following.

	Item	Description	Manufacturer	Finish*
6	Hanging Devices	Weld on Pivots	Technical Glass Products	PTM
1	Lever Trim	LX Series Control Trim Lever Set HBSR1GN#-*#-yyy-630	Technical Glass Products	630
1	Mortise Lock	Mortise lock with panic function	Technical Glass Products	630
1	Cylinder	ANSI Mortise Schlage C Keyway	Technical Glass Products	630
2	Cylinder Cover Plates	Profile cylinder cover plate	Technical Glass Products	626
2	Closing Devices	TS 93 Surface Applied Closer	Dorma	689
1	Coordinator	GSR	Dorma	689
1	Flush Bolt Set	Automatic or Semi-Automatic Flush bolt with dust proof recessed strike	Trimco	626
2	Auto door Bottoms	420APKL Smoke Seal	Pemko	MA
1	Weather Seal	Perimeter Gasket	Technical Glass Products	

Balance of hardware by others

D. Operating hardware for Fireframes® Heat Barrier Series **Active-Fixed Pair of Doors with Exit Device Outswing**. Each pair to have the following.

	Item	Description	Manufacturer	Finish*
6	Hanging Devices	Weld on Pivots	Technical Glass Products	PTM
1	Exit Device	3527A-F Surface Vertical Rod	Von Duprin	626
1	Lever Trim	360 L Rectangular Lever Handle	Von Duprin	626
1	Cylinder	ANSI Mortise Schlage C Keyway	Technical Glass Products	626
2	Closing Devices	TS 93 Surface Applied Closer	Dorma	689

1	Coordinator	GSR	Dorma	689
1	Flush Bolt Set	Automatic or Semi-Automatic Flush bolt with dust proof recessed strike	Trimco	626
2	Auto door Bottoms	420APKL Smoke Seal	Pemko	MA
1	Weather Seal	Perimeter Gasket	Technical Glass Products	
	Balance of hardware by others			

E. Operating hardware for Fireframes® Heat Barrier Series **Active-Active Pair of Doors with Exit Device Outswing**. Each pair to have the following.

	Item	**Description**	**Manufacturer**	**Finish***
6	Hanging Devices	Weld on Pivots	Technical Glass Products	PTM
2	Exit Device	3527A-F Surface Vertical Rod	Von Duprin	626
2	Lever Trim	360 L Rectangular Lever Handles	Von Duprin	626
1	Cylinder	ANSI Mortise Schlage C Keyway	Technical Glass Products	626
2	Closing Devices	TS 93 Surface Applied Closer	Dorma	689
1	Auxiliary Fire Latch	Used with exit device with no bottom rod	Technical Glass Products	630
2	Auto door Bottoms	420APKL Smoke Seal	Pemko	MA
1	Weather Seal	Perimeter Gasket	Technical Glass Products	
	Balance of hardware by others			

* FINISH LEGEND:

PTM	Painted to match frame
MA	Mill Finish Aluminum
689	Aluminum Paint
630	Satin Stainless Steel
626	Satin Chrome Plated

2.8 ACCESSORY MATERIALS

A. Bituminous Paint: Cold-applied, asphalt-mastic paint complying with SSPC-Paint 12 requirements except containing no asbestos; formulated for **30-mil [0.762-mm]** thickness per coat.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and members to which the work of this section attaches or adjoins prior to frame installation.

B. Provide openings plumb, square and within allowable tolerances.
   1. The manufacturer recommends 3/8 inch shim space at all walls

C. Notify Architect of any conditions which jeopardize the integrity of the proposed fire wall / door system.

D. Do not proceed until such conditions are corrected.

3.2 INSTALLATION

A. See Fireframes Heat Barrier Installation Manual.

3.3 REPAIR AND TOUCH UP

A. Limited to minor repair of small scratches. Use only manufacturer's recommended products.
   1. Such repairs shall match original finish for quality or material and view.

B. Remove and replace glass that is broken, chipped, cracked, abraded, or damaged.

3.4 ADJUSTING

A. Adjust door function and hardware for smooth operation. Coordinate with other hardware suppliers for function and use of any other attached hardware.

3.5 PROTECTION AND CLEANING

A. Protect glass from damage immediately after installation by attaching crossed streamers to framing held away from glass. Do not apply markers to glass surface. Remove nonpermanent labels, and clean surfaces.
   1. Do not clean with astringent cleaners. Use a clean "grit free" cloth and a small amount of mild soap and water or mild detergent.

B. Protect glass from contact with contaminating substances resulting from construction operations, including weld splatter. If, despite such protection, contaminating substances do come into contact with glass, remove them immediately as recommended by glass manufacturer.

C. Wash glass on both exposed surfaces in each area of Project not more than four days before date scheduled for inspections that establish date of Substantial Completion. Wash glass as recommended by glass manufacturer.

END OF SECTION

SECTION 08 71 00

DOOR HARDWARE

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

A. Section includes:

1. Mechanical and electrified door hardware for:

   a. Swinging doors.

2. Electronic access control system components, including:

   a. Biometric access control reader.
   b. Electronic access control devices.

3. Field verification, preparation and modification of existing doors and frames to receive new door hardware.
4. Lead-lining door hardware items required for radiation protection at door openings.
5. The intent of the hardware specification is to specify the hardware for interior and exterior doors, and to establish a type, continuity, and standard of quality. However, it is the door hardware supplier's responsibility to thoroughly review existing conditions, schedules, specifications, drawings, and other Contract Documents to verify the suitability of the hardware specified.

B. Exclusions: Unless specifically listed in hardware sets, hardware is not specified in this section for:

1. Windows
2. Cabinets (casework), including locks in cabinets
3. Signage
4. Toilet accessories
5. Overhead doors

C. Related Sections:

1. Division 01 Section "Alternates" for alternates affecting this section.
2. Division 07 Section "Joint Sealants" for sealant requirements applicable to threshold installation specified in this section.
3. Division 09 sections for touchup, finishing or refinishing of existing openings modified by this section.

4. Division 13 Section “Radiation Protection” for requirements for lead-lining for door hardware at openings indicated to receive radiation protection.
5. Division 28 sections for coordination with other components of electronic access control system.

1.03 REFERENCES

A. UL - Underwriters Laboratories

1. UL 10B - Fire Test of Door Assemblies
2. UL 10C - Positive Pressure Test of Fire Door Assemblies
3. UL 1784 - Air Leakage Tests of Door Assemblies
4. UL 305 - Panic Hardware

B. DHI - Door and Hardware Institute

1. Sequence and Format for the Hardware Schedule
2. Recommended Locations for Builders Hardware
3. Key Systems and Nomenclature

C. ANSI - American National Standards Institute

1. ANSI/BHMA A156.1 - A156.29, and ANSI/BHMA A156.31 - Standards for Hardware and Specialties

1.04 SUBMITTALS

A. General:

1. Submit in accordance with Conditions of Contract and Division 01 requirements.
2. Highlight, encircle, or otherwise specifically identify on submittals deviations from Contract Documents, issues of incompatibility or other issues which may detrimentally affect the Work.
3. Prior to forwarding submittal, comply with procedures for verifying existing door and frame compatibility for new hardware, as specified in PART 3, “EXAMINATION” article, herein.

B. Action Submittals:

1. Product Data: Technical product data for each item of door hardware, installation instructions, maintenance of operating parts and finish, and other information necessary to show compliance with requirements.
2. Riser and Wiring Diagrams: After final approval of hardware schedule, submit details of electrified door hardware, indicating:

a. Wiring Diagrams: For power, signal, and control wiring and including:
1) Details of interface of electrified door hardware and building safety and security systems.
2) Schematic diagram of systems that interface with electrified door hardware.
3) Point-to-point wiring.
4) Risers.

3. Samples for Verification: If requested by Architect, submit production sample or sample installations of each type of exposed hardware unit in finish indicated, and tagged with full description for coordination with schedule.

    a. Samples will be returned to supplier. Units that are acceptable to Architect may, after final check of operations, be incorporated into Work, within limitations of key coordination requirements.

4. Door Hardware Schedule: Submit schedule with hardware sets in vertical format as illustrated by Sequence of Format for the Hardware Schedule as published by the Door and Hardware Institute. Indicate complete designations of each item required for each door or opening, include:

    a. Door Index; include door number, heading number, and Architects hardware set number.
    b. Opening Lock Function Spreadsheet: List locking device and function for each opening.
    c. Quantity, type, style, function, size, and finish of each hardware item.
    d. Name and manufacturer of each item.
    e. Fastenings and other pertinent information.
    f. Location of each hardware set cross-referenced to indications on Drawings.
    g. Explanation of all abbreviations, symbols, and codes contained in schedule.
    h. Mounting locations for hardware.
    i. Door and frame sizes and materials.
    j. Name and phone number for local manufacturer's representative for each product.
    k. Operational Description of openings with any electrified hardware (locks, exits, electromagnetic locks, electric strikes, automatic operators, door position switches, magnetic holders or closer/holder units, and access control components). Operational description should include operational descriptions for: egress, ingress (access), and fire/smoke alarm connections.
        1) Submittal Sequence: Submit door hardware schedule concurrent with submissions of Product Data, Samples, and Shop Drawings. Coordinate submission of door hardware schedule with scheduling requirements of other work to facilitate fabrication of other work that is critical in Project construction schedule.

5. Key Schedule:

    a. After Keying Conference, provide keying schedule listing levels of keying as well as explanation of key system's function, key symbols used and door numbers controlled.
    b. Use ANSI/BHMA A156.28 “Recommended Practices for Keying Systems” as guideline for nomenclature, definitions, and approach for selecting optimal keying system.
    c. Provide 3 copies of keying schedule for review prepared and detailed in accordance with referenced DHI publication. Include schematic keying diagram and index each key to unique door designations.
    d. Index keying schedule by door number, keyset, hardware heading number, cross keying instructions, and special key stamping instructions.
    e. Provide one complete bitting list of key cuts and one key system schematic illustrating system usage and expansion.
        1) Forward bitting list, key cuts and key system schematic directly to Owner, by means as directed by Owner.

    f. Prepare key schedule by or under supervision of supplier, detailing Owner’s final keying instructions for locks.

6. Templates: After final approval of hardware schedule, provide templates for doors, frames and other work specified to be factory or shop prepared for door hardware installation.

C. Informational Submittals:

1. Qualification Data: For Supplier, Installer and Architectural Hardware Consultant.
2. Product data for electrified door hardware:

   a. Certify that door hardware approved for use on types and sizes of labeled fire-rated doors complies with listed fire-rated door assemblies.

3. Certificates of Compliance:

   a. UL listings for fire-rated hardware and installation instructions if requested by Architect or Authority Having Jurisdiction.
   b. Installer Training Meeting Certification: Letter of compliance, signed by Contractor, attesting to completion of installer training meeting specified in “QUALITY ASSURANCE” article, herein.
   c. Electrified Hardware Coordination Conference Certification: Letter of compliance, signed by Contractor, attesting to completion of electrified hardware coordination conference, specified in “QUALITY ASSURANCE” article, herein.

4. Warranty: Special warranty specified in this Section.

D. Closeout Submittals:

1. Operations and Maintenance Data: Provide in accordance with Division 01 and include:

   a. Complete information on care, maintenance, and adjustment; data on repair and replacement parts, and information on preservation of finishes.
   b. Catalog pages for each product.
   c. Factory order acknowledgement numbers (for warranty and service)
   d. Name, address, and phone number of local representative for each manufacturer.
   e. Parts list for each product.
   f. Final approved hardware schedule, edited to reflect conditions as-installed.
   g. Final keying schedule
   h. Copies of floor plans with keying nomenclature
   i. As-installed wiring diagrams for each opening connected to power, both low voltage and 110 volts.
   j. Copy of warranties including appropriate reference numbers for manufacturers to identify project.

1.05 QUALITY ASSURANCE

A. Supplier Qualifications and Responsibilities: Recognized architectural hardware supplier with record of successful in-service performance for supplying door hardware similar in quantity, type, and quality to that indicated for this Project and that provides certified Architectural Hardware Consultant (AHC) available to Owner, Architect, and Contractor, at reasonable times during the Work for consultation.

1. Warehousing Facilities: In Project's vicinity.
2. Scheduling Responsibility: Preparation of door hardware and keying schedules.

3. Engineering Responsibility: Preparation of data for electrified door hardware, including Shop Drawings, based on testing and engineering analysis of manufacturer's standard units in assemblies similar to those indicated for this Project.
4. Coordination Responsibility: Assist in coordinating installation of electronic security hardware with Architect and electrical engineers and provide installation and technical data to Architect and other related subcontractors.

    a. Upon completion of electronic security hardware installation, inspect and verify that all components are working properly.

B. Architectural Hardware Consultant Qualifications: Person who is experienced in providing consulting services for door hardware installations that are comparable in material, design, and extent to that indicated for this Project and meets these requirements:

1. For door hardware, DHI-certified, Architectural Hardware Consultant (AHC).
2. Can provide installation and technical data to Architect and other related subcontractors.
3. Can inspect and verify components are in working order upon completion of installation.

C. Single Source Responsibility: Obtain each type of door hardware from single manufacturer.

D. Fire-Rated Door Openings: Provide door hardware for fire-rated openings that complies with NFPA 80 and requirements of authorities having jurisdiction. Provide only items of door hardware that are listed products tested by Underwriters Laboratories, Intertek Testing Services, or other testing and inspecting organizations acceptable to authorities having jurisdiction for use on types and sizes of doors indicated, based on testing at positive pressure and according to NFPA 252 or UL 10C and in compliance with requirements of fire-rated door and door frame labels.

E. Electrified Door Hardware: Listed and labeled as defined in NFPA 70, Article 100, by testing agency acceptable to authorities having jurisdiction.

F. Accessibility Requirements: For door hardware on doors in an accessible route, comply with governing accessibility regulations cited in “REFERENCES” article, herein.

G. Keying Conference

1. Incorporate keying conference decisions into final keying schedule after reviewing door hardware keying system including:

    a. Function of building, flow of traffic, purpose of each area, degree of security required, and plans for future expansion.
    b. Preliminary key system schematic diagram.
    c. Requirements for key control system.
    d. Requirements for access control.
    e. Address for delivery of keys.

H. Pre-installation Conference

1. Review and finalize construction schedule and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
2. Inspect and discuss preparatory work performed by other trades.
3. Review sequence of operation for each type of electrified door hardware.
4. Review required testing, inspecting, and certifying procedures.

I. Coordination Conferences:

1. Installation Coordination Conference: Prior to hardware installation, schedule and hold meeting to review questions or concerns related to proper installation and adjustment of door hardware.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Inventory door hardware on receipt and provide secure lock-up for hardware delivered to Project site.

B. Tag each item or package separately with identification coordinated with final door hardware schedule, and include installation instructions, templates, and necessary fasteners with each item or package.

1. Deliver each article of hardware in manufacturer's original packaging.

C. Project Conditions:

1. Maintain manufacturer-recommended environmental conditions throughout storage and installation periods.
2. Provide secure lock-up for door hardware delivered to Project. Control handling and installation of hardware items so that completion of Work will not be delayed by hardware losses both before and after installation.

D. Protection and Damage:

1. Promptly replace products damaged during shipping.
2. Handle hardware in manner to avoid damage, marring, or scratching. Correct, replace or repair products damaged during Work.
3. Protect products against malfunction due to paint, solvent, cleanser, or any chemical agent.

E. Deliver keys to manufacturer of key control system for subsequent delivery to Owner.

F. Deliver keys and permanent cores to Owner by registered mail or overnight package service.

1.07 COORDINATION

A. Coordinate layout and installation of floor-recessed door hardware with floor construction. Cast anchoring inserts into concrete.

B. Installation Templates: Distribute for doors, frames, and other work specified to be factory or shop prepared. Check Shop Drawings of other work to confirm that adequate provisions are made for locating and installing door hardware to comply with indicated requirements.

C. Security: Coordinate installation of door hardware, keying, and access control with Owner's security consultant.

1.08 WARRANTY

A. Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of door hardware that fail in materials or workmanship within specified warranty period.

1. Warranty Period: Beginning from date of Substantial Completion, for durations indicated.

a. Closers:
1) Mechanical: 10 years.

b. Locksets:
1) Mechanical: 3 years.

c. Continuous Hinges: Lifetime warranty.
d. Key Blanks: Lifetime

2. Warranty does not cover damage or faulty operation due to improper installation, improper use or abuse.

1.09 MAINTENANCE

A. Maintenance Tools: Furnish complete set of special tools required for maintenance and adjustment of hardware, including changing of cylinders.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. The Owner requires use of certain products for their unique characteristics and project suitability to insure continuity of existing and future performance and maintenance standards. After investigating available product offerings, the Awarding Authority has elected to prepare proprietary specifications. These products are specified with the notation: “No Substitute.”

1. Where “No Substitute” is noted, submittals and substitution requests for other products will not be considered.

B. Approval of manufacturers and/or products other than those listed as “Scheduled Manufacturer” or “Acceptable Manufacturers” in the individual article for the product category shall be in accordance with QUALITY ASSURANCE article, herein.

C. Approval of products from manufacturers indicated in “Acceptable Manufacturers” is contingent upon those products providing all functions and features and meeting all requirements of scheduled manufacturer’s product.

D. Where specified hardware is not adaptable to finished shape or size of members requiring hardware, furnish suitable types having same operation and quality as type specified, subject to Architect's approval.

2.02 MATERIALS

A. Fasteners

1. Provide hardware manufactured to conform to published templates, generally prepared for machine screw installation.
2. Furnish screws for installation with each hardware item. Finish exposed (exposed under any condition) screws to match hardware finish, or, if exposed in surfaces of other work, to match finish of this other work including prepared for paint surfaces to receive painted finish.
3. Provide concealed fasteners for hardware units exposed when door is closed except when no standard units of type specified are available with concealed fasteners. Do not use thru-bolts for installation where bolt head or nut on opposite face is exposed in other work unless thru-bolts are required to fasten hardware securely. Review door specification and advise Architect if thru-bolts are required.
4. Install hardware with fasteners provided by hardware manufacturer.

B. Modification and Preparation of Existing Doors: Where existing door hardware is indicated to be removed and reinstalled.

1. Provide necessary fillers, Dutchmen, reinforcements, and fasteners, compatible with existing materials, as required for mounting new opening hardware and to cover existing door and frame preparations.
2. Use materials which match materials of adjacent modified areas.
3. When modifying existing fire-rated openings, provide materials permitted by NFPA 80 as required to maintain fire-rating.

C. Provide screws, bolts, expansion shields, drop plates and other devices necessary for hardware installation.

1. Where fasteners are exposed to view: Finish to match adjacent door hardware material.

2.03 HINGES

A. Manufacturers and Products:

1. Scheduled Manufacturer and Product: Ives 5BB series.
2. Acceptable Manufacturers and Products: Hager BB series, McKinney TA/T4A series

B. Requirements:

1. Provide hinges conforming to ANSI/BHMA A156.1.
2. 1-3/4 inch (44 mm) thick doors, up to and including 36 inches (914 mm) wide:

a. Exterior: Standard weight, bronze or stainless steel, 4-1/2 inches (114 mm) high
b. Interior: Standard weight, steel, 4-1/2 inches (114 mm) high

3. 1-3/4 inch (44 mm) thick doors over 36 inches (914 mm) wide:

a. Exterior: Heavy weight, bronze/stainless steel, 5 inches (127 mm) high
b. Interior: Heavy weight, steel, 5 inches (127 mm) high

4. 2 inches or thicker doors:

a. Exterior: Heavy weight, bronze or stainless steel, 5 inches (127 mm) high
b. Interior: Heavy weight, steel, 5 inches (127 mm) high

5. Provide three hinges per door leaf for doors 90 inches (2286 mm) or less in height, and one additional hinge for each 30 inches (762 mm) of additional door height.
6. Where new hinges are specified for existing doors or existing frames, provide new hinges of identical size to hinge preparation present in existing door or existing frame.
7. Hinge Pins: Except as otherwise indicated, provide hinge pins as follows:

a. Steel Hinges: Steel pins
b. Non-Ferrous Hinges: Stainless steel pins
c. Out-Swinging Exterior Doors: Non-removable pins
d. Out-Swinging Interior Lockable Doors: Non-removable pins
e. Interior Non-lockable Doors: Non-rising pins

8. Width of hinges: 4-1/2 inches (114 mm) at 1-3/4 inch (44 mm) thick doors, and 5 inches (127 mm) at 2 inches (51 mm) or thicker doors. Adjust hinge width as required for door, frame, and wall conditions to allow proper degree of opening.
9. Provide mortar guard for each electrified hinge specified.
10. Provide spring hinges where specified. Provide two spring hinges and one bearing hinge per door leaf for doors 90 inches (2286 mm) or less in height. Provide one additional bearing hinge for each 30 inches (762 mm) of additional door height.

2.04 FLUSH BOLTS

A. Manufacturers:

1. Scheduled Manufacturer: Ives.
2. Acceptable Manufacturers: Burns, Rockwood.

B. Requirements:

1. Provide automatic, constant latching, and manual flush bolts with forged bronze or stainless-steel face plates, extruded brass levers, and with wrought brass guides and strikes. Provide 12 inch (305 mm) steel or brass rods at doors up to 90 inches (2286 mm) in height. For doors over 90 inches (2286 mm) in height increase top rods by 6 inches (152 mm) for each additional 6 inches (152 mm) of door height. Provide dust-proof strikes at each bottom flush bolt.

2.05 MORTISE LOCKS

A. Manufacturers and Products:

1. Scheduled Manufacturer and Product: Schlage L9000 series.
2. Acceptable Manufacturers and Products: No substitute.

B. Requirements:

1. Provide mortise locks conforming to ANSI/BHMA A156.13 Series 1000, Grade 1, and UL Listed for 3 hour fire doors.
2. Provide locks manufactured from heavy gauge steel, containing components of steel with a zinc dichromate plating for corrosion resistance.

3. Provide lock case that is multi-function and field reversible for handing without opening case. Cylinders: Refer to “KEYING” article, herein.
4. Provide locks with standard 2-3/4 inches (70 mm) backset with full 3/4 inch (19 mm) throw stainless steel mechanical anti-friction latchbolt. Provide deadbolt with full 1 inch (25 mm) throw, constructed of stainless steel.
5. Provide standard ASA strikes unless extended lip strikes are necessary to protect trim.
6. Provide electrified options as scheduled in the hardware sets. Where scheduled, provide switches and sensors integrated into the locks and latches.
7. Lever Trim: Solid brass, bronze, or stainless steel, cast or forged in design specified, with wrought roses and external lever spring cages. Provide thru-bolted levers with 2-piece spindles.

    a. Lever Design: Schlage 06A
    b. Tactile Warning (Knurling): Where required by authority having jurisdiction. Provide on levers on exterior (secure side) of doors serving rooms considered to be hazardous.

2.06 CYLINDERS

A. Manufacturers:

1. Scheduled Manufacturer: To match existing key system

B. Requirements:

1. Provide cylinders/cores to match Owner’s existing key system, compliant with ANSI/BHMA A156.5; latest revision; cylinder face finished to match lockset, manufacturer’s series as indicated. Refer to “KEYING” article, herein.

2.07 DOOR CLOSERS

A. Manufacturers and Products:

1. Scheduled Manufacturer and Product: LCN 4010/4110/4020 series.
2. Acceptable Manufacturers and Products: No Substitute

B. Requirements:

1. Provide door closers conforming to ANSI/BHMA A156.4 Grade 1 requirements by BHMA certified independent testing laboratory. Certify surface mounted mechanical closers to meet fifteen million (15,000,000) full load cycles. ISO 9000 certify closers. Stamp units with date of manufacture code.
2. Provide door closers with fully hydraulic, full rack and pinion action with high strength cast iron cylinder, and full complement bearings at shaft.
3. Cylinder Body: 1-1/2 inch (38 mm) diameter with 11/16 inch (17 mm) diameter double heat-treated pinion journal.
4. Hydraulic Fluid: Fireproof, passing requirements of UL10C, and requiring no seasonal closer adjustment for temperatures ranging from 120 degrees F to -30 degrees F.
5. Spring Power: Continuously adjustable over full range of closer sizes, and providing reduced opening force as required by accessibility codes and standards.
6. Hydraulic Regulation: By tamper-proof, non-critical valves, with separate adjustment for latch speed, general speed, and backcheck.

7. Provide closers with solid forged steel main arms and factory assembled heavy-duty forged forearms for parallel arm closers. When closers are parallel arm mounted, provide closers which mount within 6-inch (152 mm) top rail without use of mounting plate so that closer is not visible through vision panel from pull side.
8. Pressure Relief Valve (PRV) Technology: Not permitted.
9. Finish for Closer Cylinders, Arms, Adapter Plates, and Metal Covers: Powder coating finish which has been certified to exceed 100 hours salt spray testing as described in ANSI/BHMA Standard A156.4 and ASTM B117, or has special rust inhibitor (SRI).
10. Provide special templates, drop plates, mounting brackets, or adapters for arms as required for details, overhead stops, and other door hardware items interfering with closer mounting.

2.08 DOOR TRIM

A. Manufacturers:

1. Scheduled Manufacturer: Ives.
2. Acceptable Manufacturers: Burns, Rockwood.

B. Requirements:

1. Provide push plates 4 inches (102 mm) wide by 16 inches (406 mm) high by 0.050 inch (1 mm) thick and beveled 4 edges. Where width of door stile prevents use of 4 inches (102 mm) wide plate, adjust width to fit.
2. Provide push bars of solid bar stock, diameter and length as scheduled. Provide push bars of sufficient length to span from center to center of each stile. Where required, mount back to back with pull.
3. Provide offset pulls of solid bar stock, diameter and length as scheduled. Where required, mount back to back with push bar.
4. Provide flush pulls as scheduled. Where required, provide back-to-back mounted model.
5. Provide pulls of solid bar stock, diameter and length as scheduled. Where required, mount back to back with push bar.
6. Provide pull plates 4 inches (102 mm) wide by 16 inches (406 mm) high by 0.050 inch (1 mm) thick, beveled 4 edges, and prepped for pull. Where width of door stile prevents use of 4 inches (102 mm) wide plate, adjust width to fit.
7. Provide wire pulls of solid bar stock, diameter and length as scheduled.
8. Provide decorative pulls as scheduled. Where required, mount back to back with pull.

2.09 PROTECTION PLATES

A. Manufacturers:

1. Scheduled Manufacturer: Ives.
2. Acceptable Manufacturers: Burns, Rockwood.

B. Requirements:

1. Provide kick plates, mop plates, and armor plates minimum of 0.050 inch (1 mm) thick, beveled four edges as scheduled. Furnish with sheet metal or wood screws, finished to match plates.
2. Sizes of plates:

a. Kick Plates: 10 inches (254 mm) high by 2 inches (51 mm) less width of door on single doors, 1 inch (25 mm) less width of door on pairs
b. Mop Plates: 4 inches (102 mm) high by 2 inches (51 mm) less width of door on single doors, 1 inch (25 mm) less width of door on pairs
c. Armor Plates: 36 inches (914 mm) high by 2 inches (51 mm) less width of door on single doors, 1 inch (25 mm) less width of door on pairs

2.10 THRESHOLDS, SEALS, DOOR SWEEPS, AUTOMATIC DOOR BOTTOMS, AND GASKETING

A. Manufacturers:

1. Scheduled Manufacturer: Zero International.
2. Acceptable Manufacturers: National Guard, Reese.

B. Requirements:

1. Provide thresholds, weather-stripping (including door sweeps, seals, and astragals) and gasketing systems (including smoke, sound, and light) as specified and per architectural details. Match finish of other items.
2. Smoke- and Draft-Control Door Assemblies: Where smoke- and draft-control door assemblies are required, provide door hardware that meets requirements of assemblies tested according to UL 1784 and installed in compliance with NFPA 105.
3. Size of thresholds:

   a. Saddle Thresholds: 1/2 inch (13 mm) high by jamb width by door width
   b. Bumper Seal Thresholds: 1/2 inch (13 mm) high by 5 inches (127 mm) wide by door width

4. Provide door sweeps, seals, astragals, and auto door bottoms only of type where resilient or flexible seal strip is easily replaceable and readily available.

2.11 SILENCERS

A. Manufacturers:

1. Scheduled Manufacturer: Ives.
2. Acceptable Manufacturers: Burns, Rockwood.

B. Requirements:

1. Provide "push-in" type silencers for hollow metal or wood frames.
2. Provide one silencer per 30 inches (762 mm) of height on each single frame, and two for each pair frame.
3. Omit where gasketing is specified.

2.12 COAT HOOKS

A. Manufacturers:

1. Scheduled Manufacturer: Ives.
2. Acceptable Manufacturers: Burns, Rockwood.

B. Provide coat hooks as specified.

2.13 FINISHES

A. Finish: BHMA 626/652 (US26D); except:

1. Push Plates, Pulls, and Push Bars: BHMA 630 (US32D)
2. Protection Plates: BHMA 630 (US32D)
3. Overhead Stops and Holders: BHMA 630 (US32D)
4. Door Closers: Powder Coat to Match
5. Wall Stops: BHMA 630 (US32D)
6. Weatherstripping: Clear Anodized Aluminum

PART 3 - EXECUTION

3.01 EXAMINATION

A. Prior to installation of hardware, examine doors and frames, with Installer present, for compliance with requirements for installation tolerances, labeled fire-rated door assembly construction, wall and floor construction, and other conditions affecting performance.

B. Field verify existing doors and frames receiving new hardware and existing conditions receiving new openings. Verify that new hardware is compatible with existing door and frame preparation and existing conditions.

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

3.02 INSTALLATION

A. Mount door hardware units at heights to comply with the following, unless otherwise indicated or required to comply with governing regulations.

1. Standard Steel Doors and Frames: ANSI/SDI A250.8.
2. Custom Steel Doors and Frames: HMMA 831.
3. Wood Doors: DHI WDHS.3, "Recommended Locations for Architectural Hardware for Wood Flush Doors."

B. Install each hardware item in compliance with manufacturer’s instructions and recommendations, using only fasteners provided by manufacturer.

C. Do not install surface mounted items until finishes have been completed on substrate. Protect all installed hardware during painting.

D. Set units level, plumb and true to line and location. Adjust and reinforce attachment substrate as necessary for proper installation and operation.

E. Drill and countersink units that are not factory prepared for anchorage fasteners. Space fasteners and anchors according to industry standards.

F. Install operating parts so they move freely and smoothly without binding, sticking, or excessive clearance.

G. Hinges: Install types and in quantities indicated in door hardware schedule but not fewer than quantity recommended by manufacturer for application indicated or one hinge for every 30 inches (750 mm) of door height, whichever is more stringent, unless other equivalent means of support for door, such as spring hinges or pivots, are provided.

H. Key Control System: Tag keys and place them on markers and hooks in key control system cabinet, as determined by final keying schedule.

I. Door Closers: Mount closers on room side of corridor doors, inside of exterior doors, and stair side of stairway doors from corridors. Mount closers so they are not visible in corridors, lobbies and other public spaces unless approved by Architect.

J. Closer/Holders: Mount closer/holders on room side of corridor doors, inside of exterior doors, and stair side of stairway doors.

K. Stops: Provide floor stops for doors unless wall or other type stops are indicated in door hardware schedule. Do not mount floor stops where they may impede traffic or present tripping hazard.

L. Perimeter Gasketing: Apply to head and jamb, forming seal between door and frame.

M. Meeting Stile Gasketing: Fasten to meeting stiles, forming seal when doors are closed.

3.03 FIELD QUALITY CONTROL

A. Engage qualified manufacturer trained representative to perform inspections and to prepare inspection reports.

1. Representative will inspect door hardware and state in each report whether installed work complies with or deviates from requirements, including whether door hardware is properly installed and adjusted.

3.04 ADJUSTING

A. Initial Adjustment: Adjust and check each operating item of door hardware and each door to ensure proper operation or function of every unit. Replace units that cannot be adjusted to operate as intended. Adjust door control devices to compensate for final operation of heating and ventilating equipment and to comply with referenced accessibility requirements.

1. Door Closers: Adjust sweep period to comply with accessibility requirements and requirements of authorities having jurisdiction.

B. Occupancy Adjustment: Approximately three to six months after date of Substantial Completion, Installer's Architectural Hardware Consultant must examine and readjust each item of door hardware, including adjusting operating forces, as necessary to ensure function of doors and door hardware.

3.05 CLEANING AND PROTECTION

A. Clean adjacent surfaces soiled by door hardware installation.

B. Clean operating items as necessary to restore proper function and finish.

C. Provide final protection and maintain conditions that ensure door hardware is without damage or deterioration at time of Substantial Completion.

3.06 DOOR HARDWARE SCHEDULE

A. Hardware items are referenced in the following hardware. Refer to the above-specifications for special features, options, cylinders/keying, and other requirements.

B. Hardware Sets:

HARDWARE SET: 01

254B 254C 257B 257C 262 263

PROVIDE EACH SGL DOOR(S) WITH THE FOLLOWING:

QTY		DESCRIPTION	CATALOG NUMBER	MFR
3	EA	HINGE	5BB1 SERIES AS SPECIFIED	IVE
1	EA	OFFICE/ENTRY LOCK	L9050 L583-363 06A	SCH
1	EA	STOP	WS407/FS436 AS SPECIFIED	IVE
1	EA	GASKETING	488S	ZER
1	EA	SINGLE HOOK	558B	IVE

HARDWARE SET: 02

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PROVIDE EACH SGL DOOR(S) WITH THE FOLLOWING:

QTY		DESCRIPTION	CATALOG NUMBER	MFR
3	EA	HINGE	5BB1 SERIES AS SPECIFIED	IVE
1	EA	PASSAGE SET	L9010 06A	SCH
1	EA	SURFACE CLOSER	4011/4111EDA AS SPECIFIED	LCN
1	EA	KICK PLATE	8400 10" X 1" LDW B-CS	IVE
1	EA	STOP	WS407/FS436 AS SPECIFIED	IVE
1	EA	GASKETING	488S	ZER

HARDWARE SET: 03

254A

PROVIDE EACH PR DOOR(S) WITH THE FOLLOWING:

QTY		DESCRIPTION	CATALOG NUMBER	MFR
6	EA	HINGE	5BB1 SERIES AS SPECIFIED	IVE
2	SET	AUTO FLUSH BOLT	FB31P/FB41P AS REQUIRED	IVE
1	EA	DUST PROOF STRIKE	DP1/DP2 AS REQUIRED	IVE
1	EA	CLASSROOM SECURITY	L9071 06A	SCH
1	EA	COORDINATOR	COR X FL X MB AS REQUIRED	IVE
2	EA	SURFACE CLOSER	4011/4111EDA AS SPECIFIED	LCN
2	EA	KICK PLATE	8400 10" X 1" LDW B-CS	IVE
2	EA	STOP	WS407/FS436 AS SPECIFIED	IVE
1	EA	WEATHERSTRIPPING	8217SBK PSA	ZER
2	EA	GASKETING	488S	ZER

END OF SECTION

SECTION 08 80 00
GLAZING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Glass.

B. Obscured glass lights where shown.

C. Glazing compounds and accessories.

1.02 RELATED REQUIREMENTS

A. Section 08 1213 - Hollow Metal Frames: Glazed borrowed lites.

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

1.03 REFERENCE STANDARDS

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

B. ASTM C864 - Standard Specification for Dense Elastomeric Compression Seal Gaskets, Setting Blocks, and Spacers; 2005 (Reapproved 2011).

C. ASTM C1036 - Standard Specification for Flat Glass; 2011e1.

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

E. ASTM C1172 - Standard Specification for Laminated Architectural Flat Glass; 2009e1.

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

G. ASTM E1300 - Standard Practice for Determining Load Resistance of Glass in Buildings; 2012a.

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

I. GANA (GM) - GANA Glazing Manual; Glass Association of North America; 2009.

J. GANA (SM) - GANA Sealant Manual; Glass Association of North America; 2008.

1.04 SUBMITTALS

A. See Section 01 3300 - Submittal Procedures, for submittal procedures.

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

1.06 QUALITY ASSURANCE

A. Perform Work in accordance with GANA Glazing Manual and GANA Sealant Manual for glazing installation methods.

B. Installer Qualifications: Company specializing in performing the work of this section with minimum 5 years documented experience.

1.07 FIELD CONDITIONS

A. Do not install glazing when ambient temperature is less than 50 degrees F (10 degrees C).

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

1.08 WARRANTY

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

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

PART 2 PRODUCTS

2.01 GLAZING TYPES

A. Type S-1 - Single Vision Glazing:
   1. Applications: All interior glazing unless otherwise indicated.
   2. Type: Annealed float glass.
   3. Tint: Clear.
   4. Thickness: 1/4 inch (6 mm).

B. Type S-2 - Single Safety Glazing: Non-fire-rated.
   1. Applications: Provide this type of glazing in the following locations:
      a. Glazed lites in doors, except fire doors.
      b. Glazed sidelights to doors, except in fire-rated walls and partitions.
      c. Other locations required by applicable federal, state, and local codes and regulations.
      d. As second panel on room interior at indicated spaces, all frames.
   2. Type: Laminated safety glass as specified.
   3. Tint: Clear.
   4. Thickness: 1/4 inch (6 mm).

C. Type S-3 - Single Safety Glazing: Fire-rated.
   1. Applications: Provide this type of glazing in the following locations:
      a. Glazed lites in fire doors.
      b. Glazed sidelights to doors, including in fire-rated walls and partitions.
      c. Other locations required by applicable federal, state, and local codes and regulations.
      d. As second panel on room interior at indicated spaces, all frames.
   2. Type: Laminated safety glass with and intumescent interlayer as glazing compounds as required.
   3. Manufacturer: Pilkington Pyrostop.
   3. Tint: Clear.
   4. Thickness: 1 -7/16 inch.
   5. Fire Rating – 60 Minutes and Greater: Fire rating classified and labeled by UL for fire ratings scheduled at opening locations on drawings, when tested in accordance with ASTM E119 and UL 263.
   5. Substitutions: No Substitutions allowed.

D. Type S-4 - Obscured Glazing: Translucent, showing shadows but not forms.
   1. Applications: Glazing indicated as Frosted. Locations on drawings
   2. Type: Etched float glass, fully tempered.
   3. Tint: Clear.
   4. Thickness: 1/4 inch (6 mm).

2.02 GLASS MATERIALS

A. Float Glass: All glazing is to be float glass unless otherwise indicated.
   1. Annealed Type: ASTM C1036, Type I, transparent flat, Class 1 clear, Quality Q3 (glazing select).
   2. Heat-Strengthened and Fully Tempered Types: ASTM C1048.
   3. Tinted Types: Color and performance characteristics as indicated.
   4. Thicknesses: As indicated; for exterior glazing comply with specified requirements for wind load design regardless of specified thickness.

B. Laminated Glass: Float glass laminated in accordance with ASTM C1172.
   1. Laminated Safety Glass: Comply with 16 CFR 1201 test requirements for Category II.
   2. Plastic Interlayer: 0.060 inch (1.52 mm) thick, minimum.
   3. Where fully tempered is specified or required, provide glass that has been tempered by the tong-less horizontal method.

2.03 GLASS MATERIALS

A. Float Glass: All glazing is to be float glass unless otherwise indicated.
   1. Annealed Type: ASTM C1036, Type I, transparent flat, Class 1 clear, Quality Q3 (glazing select).
   2. Heat-Strengthened and Fully Tempered Types: ASTM C1048.
   3. Tinted Types: Color and performance characteristics as indicated.
   4. Thicknesses: As indicated; for exterior glazing comply with specified requirements for wind load design regardless of specified thickness.

B. Laminated Glass: Float glass laminated in accordance with ASTM C1172.
   1. Plastic Interlayer: 0.060 inch (1.52 mm) thick, minimum.
   2. Where fully tempered is specified or required, provide glass that has been tempered by the tong-less horizontal method.

2.04 GLAZING COMPOUNDS

A. Manufacturers:
   1. Bostik Inc: www.bostik-us.com.
   2. Momentive Performance Materials, Inc (formerly GE Silicones): www.momentive.com.
   3. Pecora Corporation: www.pecora.com.
   4. BASF Construction Chemicals-Building Systems: www.buildingsystems.basf.com.
   5. Substitutions: Refer to Section 01 6000 - Product Requirements.

B. Glazing Putty: Polymer modified latex recommended by manufacturer for outdoor use, knife grade consistency; grey color.

C. Silicone Sealant: Single component; neutral curing; capable of water immersion without loss of properties; non-bleeding, non-staining; ASTM C 920, Type S, Grade NS, Class 25, Uses M, A, and G; cured Shore A hardness of 15 to 25; black.

2.05 GLAZING ACCESSORIES

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

B. Spacer Shims: Neoprene, 50 to 60 Shore A durometer hardness, ASTM C 864 Option I. Minimum 3 inch (75 mm) long x one half the height of the glazing stop x thickness to suit application, self adhesive on one face.

C. Glazing Tape: Preformed butyl compound with integral resilient tube spacing device; 10 to 15 Shore A durometer hardness; coiled on release paper; black.

D. Glazing Gaskets: Resilient silicone extruded shape to suit glazing channel retaining slot; ASTM C864 Option I, black.

E. Glazing Clips: Manufacturer's standard type.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that openings for glazing are correctly sized and within tolerance.

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

3.02 INSTALLATION - INTERIOR DRY METHOD (TAPE AND TAPE)

A. Cut glazing tape to length and set against permanent stops, projecting 1/16 inch (1.6 mm) above sight line.

B. Place setting blocks at 1/4 points with edge block no more than 6 inches (150 mm) from corners.

C. Rest glazing on setting blocks and push against tape for full contact at perimeter of pane or unit.

D. Place glazing tape on free perimeter of glazing in same manner described above.

E. Install removable stop without displacement of tape. Exert pressure on tape for full continuous contact.

F. Knife trim protruding tape.

3.03 CLEANING

A. Remove glazing materials from finish surfaces.

B. Remove labels after Work is complete.

C. Clean glass and adjacent surfaces.

END OF SECTION

SECTION 09 2116
GYPSUM BOARD ASSEMBLIES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Metal stud wall framing.

B. Gypsum wallboard.

C. Joint treatment and accessories.

1.02 RELATED REQUIREMENTS

A. Section 06 1000 - Rough Carpentry: Wood blocking product and execution requirements.

B. Section 07 9200 - Joint Sealants: Sealing gaps in construction other than gypsum board or plaster work.

1.03 REFERENCE STANDARDS

A. ASTM C475/C475M - Standard Specification for Joint Compound and Joint Tape for Finishing Gypsum Board; 2015.

B. ASTM C645 - Standard Specification for Nonstructural Steel Framing Members; 2014.

C. ASTM C754 - Standard Specification for Installation of Steel Framing Members to Receive Screw-Attached Gypsum Panel Products; 2015.

D. ASTM C840 - Standard Specification for Application and Finishing of Gypsum Board; 2013.

E. ASTM C954 - Standard Specification for Steel Drill Screws for the Application of Gypsum Panel Products or Metal Plaster Bases to Steel Studs From 0.033 in. (0.84 mm) to 0.112 in. (2.84 mm) in Thickness; 2015.

F. ASTM C1002 - Standard Specification for Steel Self-Piercing Tapping Screws for Application of Gypsum Panel Products or Metal Plaster Bases to Wood Studs or Steel Studs; 2014.

G. ASTM C1047 - Standard Specification for Accessories For Gypsum Wallboard and Gypsum Veneer Base; 2014a.

H. ASTM C1396/C1396M - Standard Specification for Gypsum Board; 2014a.

I. ASTM C1629/C1629M - Standard Classification for Abuse-Resistant Nondecorated Interior Gypsum Panel Products and Fiber-Reinforced Cement Panels; 2015.

J. GA-216 - Application and Finishing of Gypsum Board; 2013.

1.04 SUBMITTALS

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

B. Product Data: Provide data on metal framing, gypsum board, accessories, and joint finishing system.

PART 2 PRODUCTS

2.01 GYPSUM BOARD ASSEMBLIES

A. Provide completed assemblies complying with ASTM C840 and GA-216.

2.02 METAL FRAMING MATERIALS

A. Manufacturers - Metal Framing, Connectors, and Accessories:
   1. Clarkwestern Dietrich Building Systems LLC; www.clarkdietrich.com.
   2. Marino; www.marinoware.com.
   3. Substitutions: See Section 01 6000 - Product Requirements.

B. Non-Loadbearing Framing System Components: ASTM C645; galvanized sheet steel, of size and properties necessary to comply with ASTM C754 for the spacing indicated, with maximum deflection of wall framing of L/120 at 5 psf (L/120 at 240 Pa).
   1. Studs: "C" shaped with flat or formed webs with knurled faces.

2. Runners: U shaped, sized to match studs.

2.03 BOARD MATERIALS

A. Manufacturers - Gypsum-Based Board:
   1. American Gypsum Company; www.americangypsum.com.
   2. Georgia-Pacific Gypsum; www.gpgypsum.com.
   3. National Gypsum Company; www.nationalgypsum.com.
   4. USG Corporation; www.usg.com.

B. Gypsum Wallboard: Paper-faced gypsum panels as defined in ASTM C1396/C1396M; sizes to minimize joints in place; ends square cut.
   1. Application: Use for vertical surfaces and ceilings, unless otherwise indicated.
   2. Thickness:
      a. Vertical Surfaces: 5/8 inch (16 mm).
   3. Paper-Faced Products:
      a. American Gypsum Company; LightRoc Gypsum Wallboard.
      b. Georgia-Pacific Gypsum; ToughRock.

C. Impact Resistant Wallboard:
   1. Application: High-traffic areas indicated.
   2. Indentation: Level 1, minimum, when tested in accordance with ASTM C1629/C1629M.
   3. Soft Body Impact: Level 3, minimum, when tested in accordance with ASTM C1629/C1629M.
   4. Paper-Faced Type: Gypsum wallboard as defined in ASTM C1396/C1396M.
   5. Thickness: 5/8 inch (16 mm).
   6. Edges: Tapered.

2.04 ACCESSORIES

A. Beads, Joint Accessories, and Other Trim: ASTM C1047, galvanized steel, or rolled zinc, unless noted otherwise.
   1. Corner Beads: Low profile for tape embedment, for 90 degree outside corners and archways.
   2. J-Beads: for tape embedment, at all joints to dissimilar materials

B. Joint Materials: ASTM C475/C475M and as recommended by gypsum board manufacturer for project conditions.
   1. Tape: 2 inch (50 mm) wide, creased paper tape for joints and corners, except as otherwise indicated.
   2. Ready-mixed vinyl-based joint compound.

C. Screws for Fastening of Gypsum Panel Products to Cold-Formed Steel Studs Less than 0.033 inch (0.84 mm) in Thickness and Wood Members: ASTM C1002; self-piercing tapping screws, corrosion resistant.

D. Screws for Fastening of Gypsum Panel Products to Steel Members from 0.033 to 0.112 inch (0.84 to 2.84 mm) in Thickness: ASTM C954; steel drill screws, corrosion resistant.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that project conditions are appropriate for work of this section to commence.

3.02 FRAMING INSTALLATION

A. Metal Framing: Install in accordance with ASTM C754 and manufacturer's instructions.

B. Studs: Space studs at 16 inches on center (at 406 mm on center).
   1. Extend partition framing to structure where indicated and to ceiling in other locations.
   2. Partitions Terminating at Ceiling: Attach ceiling runner securely to ceiling track in accordance with manufacturer's instructions.

C. Blocking: Install wood blocking for support of:

1. Wall mounted door hardware.
2. Visual Display Monitors
3. White boards

3.03 BOARD INSTALLATION

A. Comply with ASTM C840, GA-216, and manufacturer's instructions. Install to minimize butt end joints, especially in highly visible locations.

B. Installation on Metal Framing: Use screws for attachment of gypsum board.

3.04 INSTALLATION OF TRIM AND ACCESSORIES

A. Control Joints: Place control joints consistent with lines of building spaces and as indicated.

B. Corner Beads: Install at external corners, using longest practical lengths.

C. Edge Trim (J Bead): Install at locations where gypsum board abuts dissimilar materials.

3.05 JOINT TREATMENT

A. Finish gypsum board in accordance with levels defined in ASTM C840, as follows:
   1. Level 4: Walls and ceilings to receive paint finish or wall coverings, unless otherwise indicated.

B. Tape, fill, and sand exposed joints, edges, and corners to produce smooth surface ready to receive finishes.
   1. Feather coats of joint compound so that camber is maximum 1/32 inch (0.8 mm).

END OF SECTION

SECTION 09 22 16
NON-STRUCTURAL METAL FRAMING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Metal partition, ceiling, and soffit framing.

B. Framing accessories.

1.02 RELATED REQUIREMENTS

A. Section 09 2116 – Gypsum Board Assemblies.

1.03 REFERENCE STANDARDS

A. AISI SG02-1 - North American Specification for the Design of Cold-Formed Steel Structural Members; American Iron and Steel Institute; 2001 with 2004 supplement. (replaced SG-971)

B. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2013.

C. ASTM C645 - Standard Specification for Nonstructural Steel Framing Members; 2013.

D. ASTM C665 - Standard Specification for Mineral-Fiber Blanket Thermal Insulation for Light Frame Construction and Manufactured Housing; 2012.

E. ASTM C754 - Standard Specification for Installation of Steel Framing Members to Receive Screw-Attached Gypsum Panel Products; 2011.

F. ASTM C1002 - Standard Specification for Steel Self-Piercing Tapping Screws for the Application of Gypsum Panel Products or Metal Plaster Bases to Wood Studs or Steel Studs; 2007.

G. ASTM E90 - Standard Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements; 2009.

H. ASTM E413 - Classification for Rating Sound Insulation; 2010.

1.04 SUBMITTALS

A. See Section 01 3300 - Submittal Procedures, for submittal procedures.

B. Shop Drawings:

1. Indicate prefabricated work, component details, stud layout, framed openings, anchorage to structure, acoustic details, type and location of fasteners, accessories, and items of other related work.
2. Describe method for securing studs to tracks, splicing, and for blocking and reinforcement of framing connections.

C. Product Data: Provide data describing framing member materials and finish, product criteria, load charts, and limitations.

D. Product Data: Provide manufacturer's data on partition head to structure connectors, showing compliance with requirements.

E. Manufacturer's Installation Instructions: Indicate special procedures and perimeter conditions requiring special attention.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Metal Framing, Connectors, and Accessories:

1. Clarkwestern Dietrich Building Systems: www.clarkdeitrich.com.
2. Marino: www.marinoware.com.
3. Simpson Strong Tie: www.strongtie.com.
4. Substitutions: See Section 01 6000 - Product Requirements.

2.02 FRAMING MATERIALS

A. Non-Loadbearing Framing System Components: ASTM C645; galvanized sheet steel, of size and properties necessary to comply with ASTM C754 for the spacing indicated, with maximum deflection of wall framing of L/240 at 5 psf (240 Pa).
   1. Studs: C shaped with flat or formed webs with knurled faces.
   2. Runners: U shaped, sized to match studs.

B. Ceiling Hangers: Type and size as specified in ASTM C754 for spacing required.

C. Partition Head to Structure Connections: Provide mechanical anchorage devices that accommodate deflection using slotted holes, screws and anti-friction bushings, preventing rotation of studs while maintaining structural performance of partition.
   1. Structural Performance: Maintain lateral load resistance and vertical movement capacity required by applicable code, when evaluated in accordance with AISI North American Specification for the Design of Cold-Formed Steel Structural Members.
   2. Material: ASTM A653/A653M steel sheet, SS Grade 50, with G60/Z180 hot dipped galvanized coating.

D. Tracks and Runners: Same material and thickness as studs, bent leg retainer notched to receive studs with provision for crimp locking to stud.

E. Furring and Bracing Members: Of same material as studs; thickness to suit purpose; complying with applicable requirements of ASTM C754.

F. Fasteners: ASTM C1002 self-piercing tapping screws.

2.03 FABRICATION

A. Fabricate assemblies of framed sections to sizes and profiles required.

B. Fit, reinforce, and brace framing members to suit design requirements.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify existing conditions before starting work.

B. Verify that rough-in utilities are in proper location.

3.02 INSTALLATION OF STUD FRAMING

A. Comply with requirements of ASTM C754.

B. Extend partition framing to structure where indicated and to ceiling in other locations.

C. Partitions Terminating at Structure: Attach top runner to structure, maintain clearance between top of studs and structure, and connect studs to track using specified mechanical devices in accordance with manufacturer's instructions; verify free movement of top of stud connections; do not leave studs unattached to track.

D. Align and secure top and bottom runners at 24 inches (600 mm) on center.

E. At partitions indicated with an acoustic rating:
   1. Provide components and install as required to produce STC rating as indicated on the drawings, based on published tests by manufacturer conducted in accordance with ASTM E90 with STC rating calculated in accordance with ASTM E413.
   2. Place one bead of acoustic sealant between runners and substrate, studs and adjacent construction.
   3. Place one bead of acoustic sealant between studs and adjacent vertical surfaces.

F. Fit runners under and above openings; secure intermediate studs to same spacing as wall studs.

G. Install studs vertically at 16 inches (400 mm) on center, as indicated on drawings or as required by manufacturers recommendation for span whichever is most stringent.

H. Align stud web openings horizontally.

I. Secure studs to tracks using crimping method. Do not weld.

J. Fabricate corners using a minimum of three studs.

K. Double stud at wall openings, door and window jambs, not more than 2 inches (50 mm) from each side of openings.

L. Coordinate erection of studs with requirements of door frames; install supports and attachments.

M. Coordinate installation of bucks, anchors, and blocking with electrical, mechanical, and other work to be placed within or behind stud framing.

3.03 CEILING AND SOFFIT FRAMING

A. Install furring after work above ceiling or soffit is complete. Coordinate the location of hangers with other work.

B. Install furring independent of walls, columns, and above-ceiling work.

C. Securely anchor hangers to structural members or embed in structural slab. Space hangers as required to limit deflection to criteria indicated. Use rigid hangers at exterior soffits.

D. Space main carrying channels at maximum 72 inch (1 800 mm) on center, and not more than 6 inches (150 mm) from wall surfaces. Lap splice securely.

E. Securely fix carrying channels to hangers to prevent turning or twisting and to transmit full load to hangers.

F. Place furring channels perpendicular to carrying channels, not more than 2 inches (50 mm) from perimeter walls, and rigidly secure. Lap splices securely.

G. Reinforce openings in suspension system that interrupt main carrying channels or furring channels with lateral channel bracing. Extend bracing minimum 24 inches (600 mm) past each opening.

H. Laterally brace suspension system.

3.04 TOLERANCES

A. Maximum Variation From True Position: 1/8 inch in 10 feet (3 mm in 3 m).

B. Maximum Variation From Plumb: 1/8 inch in 10 feet (3 mm in 3 m).

END OF SECTION

SECTION 09 5100
SUSPENDED ACOUSTICAL CEILINGS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Suspended metal grid ceiling system.

B. Acoustical units.

1.02 RELATED REQUIREMENTS

A. Section 23 3700 - Air Outlets and Inlets: Air diffusion devices in ceiling.

B. Section 26 5100 - Interior Lighting: Light fixtures in ceiling system.

1.03 REFERENCE STANDARDS

A. ASTM C635/C635M - Standard Specification for the Manufacture, Performance, and Testing of Metal Suspension Systems for Acoustical Tile and Lay-in Panel Ceilings; 2013a.

B. ASTM E1264 - Standard Classification for Acoustical Ceiling Products; 2014.

1.04 SUBMITTALS

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

B. Product Data: Provide data on suspension system components.

C. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
   1. See Section 01 6000 - Product Requirements, for additional provisions.
   2. Extra Acoustical Units: Quantity equal to 5 percent of total installed.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. AcousticTiles/Panels:
   1. Armstrong World Industries, Inc; www.armstrong.com.
   2. CertainTeed Corporation; www.certainteed.com.
   3. USG; www.usg.com.
   4. Substitutions: See Section 01 6000 - Product Requirements.

B. Suspension Systems:
   1. Armstrong World Industries, Inc; www.armstrong.com.
   2. CertainTeed Corporation; www.certainteed.com.
   3. USG; www.usg.com.

C. Cloud System:
   1. Basis of Design: Armstrong MetalWorks Linear with 6” Axiom Trim.
   2. Surface texture: Smooth
   3. Color: Silver Grey
   4. Suspension system: Cable with adjustable trim clip.

2.02 ACOUSTICAL UNITS

A. Acoustical Units - General: ASTM E1264, Class A.

B. Acoustical Tile Type III: Painted mineral fiber, ASTM E1264 Type III, with the following characteristics:
   1. Size: 24 by 24 inches
   2. Thickness: 5/8 inches
   3. Edge: Square.
   4. Surface Color: White.
   5. Products:

a. Fine Fissured by Armstrong #1831. URI standard tile.

2.03 SUSPENSION SYSTEM(S)

A. Suspension Systems - General: Complying with ASTM C635/C635M; die cut and interlocking components, with stabilizer bars, clips, splices, perimeter moldings, and hold down clips as required.

B. Exposed Steel Suspension System: Formed steel, commercial quality cold rolled; intermediate-duty.
   1. Profile: Tee; 15/16 inch (24 mm) wide face.
   2. Construction: Double web.
   3. Finish: White painted.

2.04 ACCESSORIES

A. Support Channels and Hangers: Galvanized steel; size and type to suit application, seismic requirements, and ceiling system flatness requirement specified.

B. Armstrong Axiom Trim or equal, 4” profile as detailed or square edge if not shown. White.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify existing conditions before starting work.

B. Verify that layout of hangers will not interfere with other work.

3.02 INSTALLATION - SUSPENSION SYSTEM

A. Rigidly secure system, including integral mechanical and electrical components, for maximum deflection of 1:360.

B. Locate system on room axis according to reflected plan.

C. Install after major above-ceiling work is complete. Coordinate the location of hangers with other work.

D. Hang suspension system independent of walls, columns, ducts, pipes and conduit. Where carrying members are spliced, avoid visible displacement of face plane of adjacent members.

E. Where ducts or other equipment prevent the regular spacing of hangers, reinforce the nearest affected hangers and related carrying channels to span the extra distance.

F. Do not support components on main runners or cross runners if weight causes total dead load to exceed deflection capability.

G. Support fixture loads using supplementary hangers located within 6 inches (150 mm) of each corner, or support components independently.

H. Do not eccentrically load system or induce rotation of runners.

3.03 INSTALLATION - ACOUSTICAL UNITS

A. Install acoustical units in accordance with manufacturer's instructions.

B. Fit acoustical units in place, free from damaged edges or other defects detrimental to appearance and function.

C. Install units after above-ceiling work is complete.

D. Install acoustical units level, in uniform plane, and free from twist, warp, and dents.

E. Cutting Acoustical Units:
   1. Make field cut edges of same profile as factory edges.

END OF SECTION

SECTION 09 65 00
RESILIENT FLOORING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Sheet vinyl flooring.

B. Resilient base.

C. Floor Prep.

1.02 REFERENCE STANDARDS

A. ASTM F1066 - Standard Specification for Vinyl Composition Floor Tile; 2004 (Reapproved 2010)e1.

B. ASTM F1861 - Standard Specification for Resilient Wall Base; 2008 (Reapproved 2012).

1.03 SUBMITTALS

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

B. Product Data: Provide data on specified products, describing physical and performance characteristics; including sizes, patterns and colors available; and installation instructions.

C. Shop Drawings: Indicate seaming plan.

D. Verification Samples: Submit two samples, 12x12 inch in size illustrating color and pattern for each resilient flooring product specified.

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

F. Certification: Prior to installation of flooring, submit written certification by flooring manufacturer and adhesive manufacturer that condition of sub-floor is acceptable.

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

1.04 FIELD CONDITIONS

A. Maintain temperature in storage area between 55 degrees F (13 degrees C) and 90 degrees F (72 degrees C).

B. Store materials for not less than 48 hours prior to installation in area of installation at a temperature of 70 degrees F (21 degrees C) to achieve temperature stability. Thereafter, maintain conditions above 55 degrees F (13 degrees C).

PART 2 PRODUCTS

2.01 VINYL FLOORING

A. Luxury Vinyl Tile:
   1. Size: 18 x 18 inch
   2. Thickness: 0.125 inch
   3. Pattern: Natural Creations Classics Aria TP780
   3. Color: Natural
   4. Manufacturers:
      a. Armstrong Flooring: www.armstrongflooring.com or equal.

2.02 RESILIENT BASE

A. Resilient Base: ASTM F1861, Type TV, vinyl, thermoplastic; top set Style B, Cove, and as follows:
   1. Height: 4 inch (100 mm).
   2. Thickness: 0.125 inch (3.2 mm) thick.
   3. Finish: Satin.
   4. Color: Roppe, 174 Smoke.
   5. Accessories: Premolded external corners and end stops
   6. Manufacturers:
      a. Roppe Corp: www.roppe.com.
      b. Mannington Commercial: www.manningtoncommercial.com.
      c. Johnsonite, a Tarkett Company: www.johnsonite.com.

2.03 ACCESSORIES

A. Sub-Floor Leveler: Premium self-leveling underlayment; type recommended by flooring material manufacturer. Ardex K15 or equal.

B. Adhesives: As approved by manufacturer for use with materials being adhered.

PART 3 EXECUTION

3.01 EXAMINATION

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

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

C. Verify that required floor-mounted utilities are in correct location.

3.02 PREPARATION

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

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

C. Prohibit traffic until filler is cured.

3.03 INSTALLATION

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

B. Install in accordance with manufacturer's instructions.

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

D. Fit joints tightly.

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

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

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

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

3.04 RESILIENT BASE

A. Fit joints tightly and make vertical. Maintain minimum dimension of 18 inches (45 mm) between joints.

B. Install base on solid backing. Bond tightly to wall and floor surfaces.

3.05 CLEANING

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

B. Clean in accordance with manufacturer's instructions.

END OF SECTION

SECTION 09 68 13
TILE CARPETING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Carpet, direct-glued.

B. Accessories.

C. Floor Prep.

1.02 RELATED REQUIREMENTS

A. Section 09 6500 – Resilient Flooring: Resilient Base.

1.03 REFERENCE STANDARDS

A. ASTM D2859 - Standard Test Method for Ignition Characteristics of Finished Textile Floor Covering Materials; 2006 (Reapproved 2011).

B. CRI (CIS) - Carpet Installation Standard; Carpet and Rug Institute; 2009.

C. CRI (GLA) - Green Label Testing Program - Approved Adhesive Products; Carpet and Rug Institute; Current Edition.

D. CRI (GLP) - Green Label Plus Carpet Testing Program - Approved Products; Carpet and Rug Institute; Current Edition.

E. NFPA 253 - Standard Method of Test for Critical Radiant Flux of Floor Covering Systems Using a Radiant Heat Energy Source; National Fire Protection Association; 2011.

1.04 SUBMITTALS

A. See Section 01 3300 - Submittal Procedures, for submittal procedures.

B. Product Data: Provide data on specified products, describing physical and performance characteristics; sizes, patterns, colors available, and method of installation.

C. Samples: Submit two carpet tiles illustrating color and pattern design for each carpet color selected.

D. Maintenance Data: Include maintenance procedures, recommended maintenance materials, and suggested schedule for cleaning.

E. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
   1. See Section 01 6000 - Product Requirements, for additional provisions.
   2. Extra Carpet Tiles: Quantity equal to 5 percent of total installed of each color and pattern installed.

1.05 QUALITY ASSURANCE

A. Installer Qualifications: Company specializing in installing carpet with minimum 5 years experience.

1.06 FIELD CONDITIONS

A. Store materials in area of installation for minimum period of 24 hours prior to installation.

B. Environmental Requirements/Conditions: In accordance with manufacturer's recommendations, areas to receive flooring should be clean, fully enclosed and weathertight. The permanent HVAC must be fully operational, controlled and set at a minimum of 68° F (20° C) for a minimum of seven days prior to, during, and seven days after the installation. The flooring material should be conditioned in the same manner for at least 48 hours prior to the installation. Areas to receive flooring shall be adequately lighted to allow for proper inspection of the substrate, installation and seaming of the flooring, and for final inspection.

1.07 WARRANTY

A. Warranty Period: Ten (10) year limited warranty commencing on Date of Substantial Completion.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Carpet:
   1. Shaw Industries Group, Inc., www.shawcontract.com or equal.
   2. Substitutions: See Section 01 6000 - Product Requirements.

2.02 MATERIALS

A. Carpet (CPT-1) :
   1. Product: Sculpt Loop Modular Rewoven Collection #5T183 manufactured by Shaw. Basis of Design.
   2. Color: Night #83496.
   3. Description: Multi-level Patterned loop eco solution q nylon fiber
   4. Size: Approx. 24” x 24”
   5. Gauge: 1/10
   6. Backing: synthetic ecoworx tile
   7. Installation: Quarter turn
   8. Substitutions: See Section 01 6000 - Product Requirements.

A. Carpet (CPT-2) :
   1. Product: Capital III 54480 Tile Collection manufactured by Shaw.
   2. Color: Executor #80401.
   3. Description: Level Loop solution q nylon fiber.
   4. Size: Approx. 24” x 24”
   5. Gauge: 1/10
   6. Backing: synthetic ecoworx tile
   7. Substitutions: See Section 01 6000 - Product Requirements.

2.03 ACCESSORIES

A. Sub-Floor Leveler: Premium self-leveling underlayment; type recommended by flooring material manufacturer. Ardex K15 or equal.

B. Adhesives: Adhesive type as recommended by flooring material manufacturer.

C. Flooring transition Strips: Vinyl, Grey color. Johnsonite or equal.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that sub-floor surfaces are dust-free and free of substances that could impair bonding of adhesive materials to sub-floor surfaces.

3.02 PREPARATION

A. Remove sub-floor ridges and bumps. Fill minor or local low spots, cracks, joints, holes, and other defects with sub-floor filler.

B. Apply, trowel, and float filler to achieve smooth, flat, hard surface. Prohibit traffic until filler is cured.

C. Vacuum clean substrate.

D. Adjacent Surfaces Protection: Protect adjacent work areas and finish surfaces from damage during product installation.

E. Surface Preparation:

1. General: Prepare floor substrate in accordance with manufacturer's instructions.
2. Floor Substrate: Floors shall be sound, smooth, flat, permanently dry, clean, and free of all foreign materials including, but not limited to, dust, paint, grease, oils, solvents, curing and hardening compounds, sealers, asphalt and old adhesive residue.
3. Concrete Floor Substrate: Concrete floor substrate shall have a minimum compressive strength of 3,000 psi. Refer to Division 3 Concrete sections for patching and repairing crack materials and leveling compounds with Portland cement based compounds.
    a. Reference Standard: Comply with the latest version of ASTM F 710 Standard Practice for Preparing Concrete Floors to Receive Resilient Flooring

F. Concrete Moisture Testing: Conduct moisture tests on <u>all</u> concrete floors regardless of the age, grade level or the presence of existing flooring. Conduct calcium chloride tests in accordance with the latest version of ASTM F 1869. Measure the internal relative humidity of the concrete slab in accordance with the latest version of ASTM F 2170. One test of each type should be conducted for every 1,000 square feet of flooring (minimum of 3). The tests should be conducted around the perimeter of the room, at columns, and anywhere moisture may be evident. Concrete moisture vapor emissions must not exceed 5.0 lbs. per 1,000 square feet in 24 hours when using Forbo FRT 950 adhesive. Concrete internal relative humidity must not exceed 75% when using Forbo FRT 950 adhesive. A diagram of the area showing the location and results of each test should be submitted to the Architect, General Contractor or End User. If the test results exceed these limitations, the installation must not proceed until the problem has been corrected.

F. Concrete pH Test: Perform pH tests on concrete floors regardless of the age or grade level. The surface pH of concrete slabs must not exceed a pH of 10. Concrete substrates with pH readings less than 7.0 or above 10.0 will require remediation prior to installation.

3.03 INSTALLATION

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

B. Install carpet tile in accordance with manufacturer's instructions and CRI Carpet Installation Standard.

C. Blend carpet from different cartons to ensure minimal variation in color match.

D. Cut carpet tile clean. Fit carpet tight to intersection with vertical surfaces without gaps.

E. Lay carpet tile in square pattern, with pile direction parallel to next unit, set parallel to building lines.

F. Fully adhere carpet tile to substrate.

G. Trim carpet tile neatly at walls and around interruptions.

H. Complete installation of edge strips, concealing exposed edges.

3.04 CLEANING

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

B. Clean and vacuum carpet surfaces.

END OF SECTION

SECTION 09 90 00
PAINTING AND COATING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Surface preparation.

B. Field application of paints and other coatings.

C. Scope: Finish all interior and exterior surfaces exposed to view, unless fully factory-finished and unless otherwise indicated, including the following:
   1. Both sides and edges of plywood backboards for electrical and telecom equipment before installing equipment.
   2. Exposed surfaces of steel lintels and ledge angles.
   3. Mechanical and Electrical:
      a. In finished areas, paint all insulated and exposed pipes, conduit, boxes, insulated and exposed ducts, hangers, brackets, collars and supports, mechanical equipment, and electrical equipment, unless otherwise indicated.
      b. In finished areas, paint shop-primed items.
      c. Paint interior surfaces of air ducts and convector and baseboard heating cabinets that are visible through grilles and louvers with one coat of flat black paint to visible surfaces.
      d. Paint dampers exposed behind louvers, grilles, and convector and baseboard cabinets to match face panels.

D. Do Not Paint or Finish the Following Items:
   1. Items fully factory-finished unless specifically so indicated; materials and products having factory-applied primers are not considered factory finished.
   2. Items indicated to receive other finishes.
   3. Items indicated to remain unfinished.
   4. Fire rating labels, equipment serial number and capacity labels, and operating parts of equipment.
   5. Stainless steel, anodized aluminum, bronze, terne, and lead items.
   6. Marble, granite, slate, and other natural stones.
   7. Floors, unless specifically so indicated.
   8. CMU, architectural concrete, cast stone, integrally colored plaster and stucco.
   9. Glass.
   10. Concealed pipes, ducts, and conduits.

1.02 REFERENCE STANDARDS

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

B. SSPC (PM1) - Good Painting Practice: SSPC Painting Manual, Vol. 1; Society for Protective Coatings; Fourth Edition.

1.03 SUBMITTALS

A. See Section 01 3300 - Submittal Procedures, for submittal procedures.

B. Product Data: Provide complete list of all products to be used, with the following information for each:
   1. Manufacturer's name, product name and/or catalog number, and general product category (e.g. "alkyd enamel").
   2. Cross-reference to specified paint system(s) product is to be used in; include description of each system.

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

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

1.04 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the products specified, with minimum three years documented experience.

1.05 DELIVERY, STORAGE, AND HANDLING

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

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

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

1.06 FIELD CONDITIONS

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

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

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

PART 2 PRODUCTS

2.01 MANUFACTURERS

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

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

C. Paints:
   1. Sherwin-Williams Company: www.sherwin-williams.com.
   2. Benjamin Moore & Co: www.benjaminmoore.com.
   2. PPG Architectural Finishes, Inc: www.ppgaf.com.

D. Primer Sealers: Same manufacturer as top coats.

E. Substitutions: See Section 01 6000 - Product Requirements.

2.02 PAINTS AND COATINGS - GENERAL

A. Paints and Coatings: Ready mixed, unless intended to be a field-catalyzed coating.
   1. Provide paints and coatings of a soft paste consistency, capable of being readily and uniformly dispersed to a homogeneous coating, with good flow and brushing properties, and capable of drying or curing free of streaks or sags.
   2. Provide materials that are compatible with one another and the substrates indicated under conditions of service and application, as demonstrated by manufacturer based on testing and field experience.
   3. Supply each coating material in quantity required to complete entire project's work from a single production run.

4. Do not reduce, thin, or dilute coatings or add materials to coatings unless such procedure is specifically described in manufacturer's product instructions.

B. Primers: Where the manufacturer offers options on primers for a particular substrate, use primer categorized as "best" by the manufacturer.

C. Volatile Organic Compound (VOC) Content:
1. Provide coatings that comply with the most stringent requirements specified in the following:
a. 40 CFR 59, Subpart D--National Volatile Organic Compound Emission Standards for Architectural Coatings.
2. Determination of VOC Content: Testing and calculation in accordance with 40 CFR 59, Subpart D (EPA Method 24), exclusive of colorants added to a tint base and water added at project site; or other method acceptable to authorities having jurisdiction.

D. Sheens: Provide the sheens specified; where sheen is not specified, sheen will be selected later by Architect from the manufacturer's full line.

E. Colors: To be selected from manufacturer's full range of available colors.
1. Selection to be made by Architect after award of contract.
2. In finished areas, finish previously painted pipes, ducts, conduit, and equipment the same color as the wall/ceiling they are mounted on/under.

2.03 PAINT SYSTEMS - INTERIOR

A. Paint I-OP - All Interior Surfaces Indicated to be Painted, Unless Otherwise Indicated: Including gypsum board, wood, plaster, uncoated steel, and shop primed steel.
1. Two top coats and one coat primer.
2. Satin: MPI gloss level 4; use this sheen for items subject to frequent touching by occupants, including door frames and railings.
3. Top Coat Product(s):
a. Sherwin-Williams ProMar 200 Zero VOC Interior Latex.
4. Primer(s): As recommended by manufacturer of top coats.

B. Paint I-OP-MD-DT - Medium Duty Door/Trim: For surfaces subject to frequent contact by occupants, including metals:
1. Two top coats and one coat primer.
2. Semi-Gloss: MPI gloss level 5; use this sheen at all locations.
3. Top Coat Product(s):
a. Sherwin-Williams ProMar 200 Waterbased Acrylic-Alkyd.
4. Primer(s): As recommended by manufacturer of top coats.

C. Paint I-OP-MD-WC - Medium Duty Vertical/Overhead: Including gypsum board, plaster, concrete, uncoated steel, and shop primed steel.
1. Two top coats and one coat primer.
2. Flat: MPI gloss level 1; use this sheen for ceilings and other overhead surfaces.
3. Top Coat Product(s):
a. Sherwin-Williams ProMar 200 Waterbased Acrylic-Alkyd.
4. Primer(s): As recommended by manufacturer of top coats.

2.04 ACCESSORY MATERIALS

A. Accessory Materials: Provide all primers, sealers, cleaning agents, cleaning cloths, sanding materials, and clean-up materials required to achieve the finishes specified whether specifically indicated or not; commercial quality.

B. Patching Material: Latex filler.

C. Fastener Head Cover Material: Latex filler.

PART 3 EXECUTION

3.01 EXAMINATION

A. Do not begin application of coatings until substrates have been properly prepared.

B. Verify that surfaces are ready to receive work as instructed by the product manufacturer.

C. Examine surfaces scheduled to be finished prior to commencement of work. Report any condition that may potentially affect proper application.

D. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

E. Test shop-applied primer for compatibility with subsequent cover materials.

F. Measure moisture content of surfaces using an electronic moisture meter. Do not apply finishes unless moisture content of surfaces are below the following maximums:
   1. Gypsum Wallboard: 12 percent.
   2. Plaster and Stucco: 12 percent.
   3. Masonry, Concrete, and Concrete Unit Masonry: 12 percent.
   4. Concrete Floors and Traffic Surfaces: 8 percent.

3.02 PREPARATION

A. Clean surfaces thoroughly and correct defects prior to coating application.

B. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.

C. Remove or repair existing coatings that exhibit surface defects.

D. Remove or mask surface appurtenances, including electrical plates, hardware, light fixture trim, escutcheons, and fittings, prior to preparing surfaces or finishing.

E. Seal surfaces that might cause bleed through or staining of topcoat.

F. Remove mildew from impervious surfaces by scrubbing with solution of tetra-sodium phosphate and bleach. Rinse with clean water and allow surface to dry.

G. Concrete and Unit Masonry Surfaces to be Painted: Remove dirt, loose mortar, scale, salt or alkali powder, and other foreign matter. Remove oil and grease with a solution of tri-sodium phosphate; rinse well and allow to dry. Remove stains caused by weathering of corroding metals with a solution of sodium metasilicate after thoroughly wetting with water. Allow to dry.

H. Gypsum Board Surfaces to be Painted: Fill minor defects with filler compound. Spot prime defects after repair.

I. Plaster Surfaces to be Painted: Fill hairline cracks, small holes, and imperfections with latex patching plaster. Make smooth and flush with adjacent surfaces. Wash and neutralize high alkali surfaces.

J. Insulated Coverings to be Painted: Remove dirt, grease, and oil from canvas and cotton.

K. Concrete Floors and Traffic Surfaces to be Painted: Remove contamination, acid etch, and rinse floors with clear water. Verify required acid-alkali balance is achieved. Allow to dry.

L. Aluminum Surfaces to be Painted: Remove surface contamination by steam or high pressure water. Remove oxidation with acid etch and solvent washing. Apply etching primer immediately following cleaning.

M. Galvanized Surfaces to be Painted: Remove surface contamination and oils and wash with solvent. Apply coat of etching primer.

N. Corroded Steel and Iron Surfaces to be Painted: Prepare using at least SSPC-PC 2 (hand tool cleaning) or SSPC-SP 3 (power tool cleaning) followed by SSPC-SP 1 (solvent cleaning).

O. Uncorroded Uncoated Steel and Iron Surfaces to be Painted: Remove grease, mill scale, weld splatter, dirt, and rust. Where heavy coatings of scale are evident, remove by hand or power tool wire brushing or sandblasting; clean by washing with solvent. Apply a treatment of phosphoric acid solution, ensuring weld joints, bolts, and nuts are similarly cleaned. Prime paint entire surface; spot prime after repairs.

P. Shop-Primed Steel Surfaces to be Finish Painted: Sand and scrape to remove loose primer and rust. Feather edges to make touch-up patches inconspicuous. Clean surfaces with solvent. Prime bare steel surfaces. Re-prime entire shop-primed item.

3.03 APPLICATION

A. Remove unfinished louvers, grilles, covers, and access panels on mechanical and electrical components and paint separately.

B. Apply products in accordance with manufacturer's instructions.

C. Where adjacent sealant is to be painted, do not apply finish coats until sealant is applied.

D. Do not apply finishes to surfaces that are not dry. Allow applied coats to dry before next coat is applied.

E. Apply each coat to uniform appearance.

F. Dark Colors and Deep Clear Colors: Regardless of number of coats specified, apply as many coats as necessary for complete hide.

G. Sand wood and metal surfaces lightly between coats to achieve required finish.

H. Vacuum clean surfaces of loose particles. Use tack cloth to remove dust and particles just prior to applying next coat.

I. Reinstall electrical cover plates, hardware, light fixture trim, escutcheons, and fittings removed prior to finishing.

3.04 CLEANING

A. Collect waste material that could constitute a fire hazard, place in closed metal containers, and remove daily from site.

3.05 PROTECTION

A. Protect finished coatings until completion of project.

B. Touch-up damaged coatings after Substantial Completion.

3.06 SCHEDULE - COLORS

A. P-1 – Field Color – Sherwin Williams – Popular Gray #SW6071 in Eggshell

B. P-2 – Trim Color – Sherwin Williams – Requisite Gray #SW 7023 in Semi-gloss

C. P-3 – Accent Color – Sherwin Williams – Revel Blue # SW 6530 in Eggshell

D. P-4 – Ceiling/Soffit Color – Sherwin Williams – Ceiling Bright White #SW 7007 in Eggshell

E. P-5 – Accent Color – Sherwin Williams – Naples Yellow # SW 9021 in Eggshell

F. P-6 – Window Frames - Sherwin Williams - Peppercorn #SW 7674

All conduit to be painted to match adjacent surfaces. Review in field with Architect.

END OF SECTION

SECTION 10 1400
SIGNAGE

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Room ID sign on hallway side for both entry and new doors.

B. Pin Letter signage on feature walls.

1.02 RELATED REQUIREMENTS

A. Division 22 and 23 - Identification for Plumbing Piping and Equipment.

B. Division 26 - Identification for Electrical Systems.

1.03 REFERENCE STANDARDS

A. 36 CFR 1191 - Americans with Disabilities Act Accessibility Guidelines for Buildings and Facilities; Final Rule; current edition; (ADA Standards for Accessible Design).

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

1.04 SUBMITTALS

A. See Section 01 3300 - Submittal Procedures, for submittal procedures.

B. Product Data: Manufacturer's printed product literature for each type of sign, indicating sign styles, font, foreground and background colors, locations, overall dimensions of each sign.

C. Signage Schedule: Provide information sufficient to completely define each sign for fabrication, including room number, room name, other text to be applied, sign and letter sizes, fonts, and colors.

1. When room numbers to appear on signs differ from those on the drawings, include the drawing room number on schedule.

2. When content of signs is indicated to be determined later, request such information from Owner through Architect at least 2 months prior to start of fabrication; upon request, submit preliminary schedule.

3. Submit for approval by Owner through Architect prior to fabrication.

E. Selection Samples: Where colors are not specified, submit two sets of color selection charts or chips.

F. Provide shop drawings for pin-mounted signage. Must be approved by Architect before ordering.

1.05 QUALITY ASSURANCE

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

1.06 DELIVERY, STORAGE, AND HANDLING

A. Package signs as required to prevent damage before installation.

B. Package room and door signs in sequential order of installation, labeled by floor or building.

C. Store tape adhesive at normal room temperature.

1.07 FIELD CONDITIONS

A. Do not install tape adhesive when ambient temperature is lower than recommended by manufacturer.

B. Maintain this minimum temperature during and after installation of signs.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Flat Signs:

1. ASI Sign Systems, Inc.; www.asisignage.com.
2. Best Sign Systems, Inc.; www.bestsigns.com.
2. Allen Industries, Inc.; www.allenindustries.com.
3. Substitutions: See Section 01 6000 - Product Requirements.

B. Pin Mounted Letters & Logo:

1. Gemini Incorporated; www.geminsignproducts.com.
   a. Product: Cut Metal Stainless Steel
2. ASI Sign Systems Incorporated; www.asisignage.com.
   a. Product: Cut Metal Series Stainless
3. Substitutions: See Section 01 6000 - Product Requirements.

2.02 FLAT SIGNS

A. Impact resistant thermoformed acrylic with radius corners and raised lettering, braille and solid color background to match existing campus signage.

B. Tactile characters/symbols shall be raised from sign plate face. Signs shall be of one-piece construction; added-on and/or engraved characters are unacceptable.

C. Text shall be accompanied by Grade 2 braille.

D. All letters, numbers and/or symbols shall contrast with their background – either light characters on a dark background or dark characters on a light background. Characters and background shall have matte finish.

2.03 SIGNAGE APPLICATIONS

A. Accessibility Compliance: All signs are required to comply with ADA Standards for Accessible Design and ANSI/ICC A 117.1 and applicable building codes, unless otherwise indicated; in the event of conflicting requirements, comply with the most comprehensive and specific requirements.

2.04 SIGN SIZE

A. Room name/number signs shall match signage standards.

2.05 ACCESSORIES

A. Tape Adhesive: Double sided tape, permanent adhesive.

B. Backer Panel at glass location to match size and color of sign.

2.06 FLAT CUT LETTERS

A. Provide stainless steel pin-mounted lettering, text per drawings.

PART 3 EXECUTION

3.01 EXAMINATION

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

3.02 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Install neatly, with horizontal edges level.

C. Locate signs where indicated:

1. Room and Door Signs: Locate on wall at latch side of door with centerline of sign at 60 inches (1525 mm) above finished floor.

2. If no location is indicated obtain Architect’s instructions.

D. Protect from damage until Substantial Completion; repair or replace damage items.

END OF SECTION

SECTION 11 31 00
APPLIANCES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Appliances.

1.02 RELATED REQUIREMENTS

A. Section 22 1005 - Plumbing Piping: Plumbing connections for appliances.

B. Section 26 2717 - Equipment Wiring: Electrical connections for appliances.

1.03 REFERENCE STANDARDS

A. UL (EAUED) - Electrical Appliance and Utilization Equipment Directory; Underwriters Laboratories Inc.; current edition.

1.04 SUBMITTALS

A. See Section 01 3300 - Submittal Procedures, for submittal procedures.

B. Product Data: Manufacturer's data indicating dimensions, capacity, and operating features of each piece of residential equipment specified.

C. Copies of Warranties: Submit manufacturer warranty and ensure that forms have been completed in Owner's name and registered with manufacturer.

1.05 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section, with not less than three years of documented experience.

B. Electric Appliances: Listed and labeled by UL and complying with NEMA standards.

1.06 WARRANTY

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

B. Provide five (5) year manufacturer warranty on refrigeration system of refrigerators.

PART 2 PRODUCTS

2.01 KITCHEN APPLIANCES

A. All Equipment: Energy Star Rated.

B. Refrigerator: Under-counter, compact.
   1. Capacity: Total minimum storage of 3 cubic ft. Fits within millwork space designed.
   3. Features: Automatic defrost.
   4. Finish: Stainless Steel.
   5. Manufacturers:
      a. Summit, FF6BADA, 32” Height
      b. Substitutions: See Section 01 6000 - Product Requirements.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify utility rough-ins are present and correctly located.

3.02 INSTALLATION

A. Install in accordance with manufacturer's instructions, including software when applicable.

B. Anchor built-in/wall-hung equipment in place.

3.03 ADJUSTING

A. Adjust operating equipment to efficient operation.

3.04 CLEANING

A. Remove packing materials from equipment.

B. Wash and clean equipment.

END OF SECTION

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SECTION 210000

FIRE PROTECTION

PART 1 - GENERAL

1.01 REFERENCES

A. This is a performance specification. It requires performance of design work, preparation and submission of shop drawings and submittal of all system components, procurement of approvals, and provision of complete functional system of automatic sprinklers. As a result, this Section serves a dual purpose of providing specifications and indicating design criteria for Contractor's use and guidance in designing systems and preparing fabricated sprinkler drawings for approvals from all authorities having jurisdiction.

1.02 SCOPE

A. Work shall include, but shall not be limited to, the following:

1. Removal of existing sprinkler heads.
2. Relocation and additional sprinkler heads to suit proposed new room layouts.
3. Wet pipe sprinkler system and all components.
4. Sprinkler heads, piping, fittings, hangers and valves.
5. Preparation of complete and detailed Shop Drawings in accordance with NFPA No. 13 and Factory Mutual requirements.
6. Visit project site and field verify existing conditions.
7. Preparation of complete and detailed working plans.
8. Submitting drawings and obtaining necessary approval, permits and certificates.
9. Tests.
10. Securing hydrant flow test data reports.
11. Hydraulic calculations.
12. All costs for required for shut-downs.

1.03 CONTRACT DOCUMENTS

A. Work to be performed under this Section is in conjunction with work shown on FP-1 Drawing.

1.04 RELATED WORK IN OTHER SECTIONS

A. The following work is not included in this section and will be performed under other Sections.

1. Electric power wiring for all equipment, except as noted.

2. Fire alarm system and controls.

1.05 SUBMITTALS

A. Materials and equipment requiring Shop Drawing Submittals and/or individual sheet submittals shall include, but not be limited to:

1. Wet pipe sprinkler system and all components including pipe, fittings, sprinkler heads, etc.
2. Sprinkler heads, pipe, fittings, hangers and valves.

a. Sprinklers shall be referred to on drawings, submittals and other documentation, by the sprinkler identification or Model number as specifically published in the appropriate agency listing or approval. Trade names or other abbreviated designations shall not be allowed.

B. Definitions

1. Shop Drawings are information prepared by the Contractor to illustrate portions of the work in more detail than shown in the Contract Documents.

2. Coordination Drawings are detailed, large-scale layout Shop Drawings showing HVAC, Electrical, Plumbing and Fire Protection work superimposed in order to identify conflicts and ensure inter-coordination of Mechanical, Electrical, Architectural, Structural and other work.

3. Individual Submittal sheets are manufacturer cut-sheets that are detailed in nature and provide all necessary “technical” information (i.e. physical size, operating weight and/or pressure, compatibility, color, etc.).

C. Submittal Cover Sheet

1. Shop Drawings shall be submitted according to specification section with a separate cover sheet completed for each product, rather than one cover sheet for multiple products, whether or not supplied by one manufacturer or vendor.

D. Submittal Procedures and Format

1. Review submittal packages for compliance with the Contract Documents and then submit to Architect for review.

2. Provide additional copies of reviewed shop drawings as required for full distribution.

3. Shop Drawings showing layouts of systems shall contain sufficient plans, elevations, sections, details and schematics to describe work clearly. They shall be ¼” = 1’ – 0” scale unless specified otherwise. Fire Protection shop drawings shall be 1/4” = 1’ – 0 and shall indicate work of other sections where interferences are possible. Provide larger scale details as necessary. Fire Protection drawings shall show elements of Architects reflected ceiling plan,

sprinkler heads, walls, partitions, pipes, equipment and sleeves and other aspects of construction as necessary for coordination.

4. Shop drawings showing manufacturer's product data shall contain detailed dimensional drawings, accurate and complete description of construction materials, manufacturer's published performance characteristics and electrical requirements. Drawings shall clearly indicate location of all drops and rises, the size of all pipe and other information necessary to demonstrate compliance with all requirements of Contract Documents.

5. Provide shop drawing submittals showing details of all equipment. If equipment submittals are not submitted and equipment is found to be installed incorrectly in the field, this contractor shall reinstall them within the original contract price.

E. Acceptable Manufacturers

1. Alternate Manufacturers are acceptable only if, as a minimum, they:

   a. Meet all performance criteria listed in the schedules and outlined in the specification.
   b. Have identical operating characteristics to those called for in the specification.
   c. Fit within the available space it was designed for, including space for maintenance and component removal, with no modification to either space or the product. Clearances to walls, ceilings and other equipment shall be at least equal to those shown on the design drawings.
   d. Fit within the specified design criteria.

F. Deviations

1. Concerning deviations other than substitutions, proposed deviations from Contract Documents shall be requested individually in writing whether deviations result from field conditions, standard shop practice, or other cause. Submit letter with transmittal of Shop Drawings, which flags the deviation to the attention of the Architect.

2. Without letters flagging the deviation to the Architect, it is possible that the Architect may not notice such deviation or may not realize its ramifications. Therefore, if such letters are not submitted to the Architect, the contractor shall hold the Architect and his consultants harmless for any and all adverse consequences resulting from the deviations being implemented. This shall apply regardless of whether the Architect has reviewed or approved shop drawings containing the deviation, and will be strictly enforced.

3. Approval of proposed deviations, if any, will be made at the discretion of the Architect.

G. Responsibility

1. Intent of Submittal review is to check for capacity, rating, and certain construction features. Contractor shall ensure that work meets requirements of Contract

Documents regarding information that pertains to fabrication processes or means, methods, techniques, sequences and procedures of construction; and for coordination of work of this and other Sections. Work shall comply with submittals marked "REVIEWED" to extent that they agree with Contract Documents. Submittal review shall not diminish responsibility under this Contract for dimensional coordination, quantities, installation, wiring, supports and access for service, nor shop drawing errors or deviations from requirements of Contract Documents. The Architect's noting of some errors while overlooking others will not excuse the contractor from proceeding in error. Contract Documents requirements are not limited, waived nor superseded in any way by review.

2. Inform subcontractors, manufacturers, suppliers, etc. of scope and limited nature of review process and enforce compliance with contract documents.

H. Schedule

1. Incorporate shop drawing review period into construction schedule so that work is not delayed. Contractor shall assume full responsibility for delays caused by not incorporating the following shop drawing review time requirements into his project schedule. Working days listed reference the time in the Engineer's office. It does not include transmittal time for review each time shop drawing is submitted or resubmitted.

I. List of Proposed Equipment and Materials

1. Within four weeks after Award of Contract and before ordering materials or equipment, submit complete list of proposed materials and equipment and indicate manufacturer's names and addresses. No consideration will be given to partial lists submitted out of sequence.

1.06 DESIGN CRITERIA

A. Provide wet-pipe sprinklers in all areas.

B. provide new sprinkler heads in new work areas.

C. All existing sprinkler heads above the ceiling are to remain.

D. Secure waterflow test data taken from fire hydrants nearest site. If recent flow test data is not available from city records, make necessary tests as required by NFPA Standards to determine character of water supply. Minimum of 20 psi drop in pressure between static and residual pressure shall be required in order to obtain accurate data.

E. Design sprinkler system in office areas by the following light hazard criteria:

1. Density
2. Sprinkler spacing
3. Hose allowance

F. Run piping horizontally and at right angles to walls and ceilings. Center sprinkler heads with respect to ceiling components, such as ceiling grid, lighting fixtures, HVAC diffusers and speakers, as directed by Architect.

G. Fire Protection system shop drawings shall include separate and complete reflected ceiling plans indicating location of each sprinkler head, as well as piping layouts. Provide additional sprinkler heads (over code minimum quantities) if requested by Architect, to obtain symmetrical ceiling layouts.

1.07 FIRE PROTECTION FABRICATION DRAWINGS

A. Submit fabrication drawings to indicate actual sprinkler system piping layout to the Architect/Engineer and Insurance Underwriter FM.

B. Hydraulic calculations: Submit hydraulic calculations per the following criteria to:

1. Architect/Engineer - only if any hydraulic datum has changed from the engineering drawings.

2. Insurance Underwriter in all cases.

3. Building Department – only if any hydraulic datum has changed from the Engineering drawings.

C. Submit Fabrication plans in one complete package.

D. Fabrication plans shall be at least 1/8” = 1” scale on sheets of uniform size. Fabrication

E. Plans shall show all data required by NFPA No. 13.

F. Fabrication Plans will be subject to Architect’s and Owner’s insurance company for final approval. Submit to Architect er) after review by other authorities. If necessary to submit plans to Architect before review by other authorities, identify authorities that have not reviewed plans and resubmit for final approval when review by all parties is complete.

G. Pipe sizing shall be based on Hydraulically Designed System for fire protection, sprinkler and/or combination systems.

H. Fire Protection contractor shall provide piping layout on measured drawings. For renovation projects, this may require Contractor to field survey existing building and prepare reproducible drawings on which to show building background and all Fire Protection work.

I. Fabrication Plans shall show all hangers and supports from floors, walls, underside of slabs and structural steel members. Where piping cannot be supported from walls or slabs, contractor shall provide additional structural steel bracing to support pipe.

1.08 UNIT PRICES

A. Subcontractor shall list the following unit prices in bid proposal, which shall include the complete installation (labor and materials) for each item:

1. Cost for addition of flush pendant head.
2. Cost for addition of semi-recessed head.
3. Cost for addition of upright head.
4. Savings or deduction for eliminating a sprinkler head.

B. Above prices shall include 10 feet of 1" piping, connection, sprinkler heads, fittings, hangers, labor, drawing involvement, and any other associated costs for the addition or deletion of a sprinkler head.

PART 2 - PRODUCTS

2.01 PIPE AND FITTINGS

A. Piping shall meet applicable ANSI or ASTM standards requirements and shall have manufacturer's name and standard marked on each length. Joints shall meet applicable ANSI or ASTM standards requirements. Where ANSI or ASTM standard does not exist, joints and fittings shall bear UL listing symbol.

Pipe Material Specification Index					
Service	**Code**	**Pressure Rating (psig)**	**Temperature Rating (ºF)**	**Class**	**Material**
Wet Pipe Sprinkler	SP1	175	70	F11	Carbon Steel
General Material Notes: System components shall be rated for the maximum working pressure to which they are exposed, but not less than 175 psig. Pipe, tube valves and fittings shall meet or exceed ASTM/ANSI standards listed in the National Fire Protection Pipe, Codes and specifically in NFPA-13. All threaded piping and fittings shall conform to thread cuts listed in American Welding Society document D10.9, Levels AR-3.					

Pipe Class F11 Item	**2" and smaller**	**2 ½" and larger**
Pipe	Welded or seamless black steel pipe Schedule 40 conforming to ASTM/ASTM A135.	Welded or seamless black steel pipe conforming to ASTM A53 Schedule 40 or Schedule 10.
Fittings	Cast Iron Class 125 fittings ANSI/ASME B16.1 and screw fittings per ANSI/ASME B16.4. Mechanical grooved couplings with ductile iron housing clamps to engage and lock, "C" shaped composition sealing gasket, ASTM A449 electroplated steel bolts, nuts and washers.	Cast Iron Class 125 fittings ANSI/ASME B16.1 and screw fittings per ANSI/ASME B16.4. Mechanical grooved couplings with ductile iron housing clamps to engage and lock, "C" shaped composition sealing gasket, ASTM A449 electroplated steel bolts, nuts and washers.
Joints	Roll groove, cut groove or thread. Apply joint compound or Teflon tape to male pipe threads on threaded systems.	Weld, roll groove, or thread. Apply joint compound or Teflon tape to male pipe threads on threaded systems. Welding procedures shall conform to the requirements of AWS D10.9, level AR3.
Flanges	Flanges shall be plain faced and shall be CI 150 and shall conform to ANSI B16.5.	Flanges be plain faced and shall be CI 150 and shall conform to ANSI B16.5
Gaskets/Bolts	Gaskets shall be full-face rubber 1/8 in. thick. Bolts and nuts shall conform to ANSI B18.2.1 and B18.2.2 respectively.	Gaskets shall be full-face rubber 1/8 in. thick. Bolts and nuts shall conform to ANSI B18.2.1 and B18.2.2 respectively.

Notes:

1. Pipe material and fittings shall meet the standards set forth for pipe and tube in the National Fire Code NFPA 13, Section 2-3.

2.02 GROOVED JOINT COUPLINGS AND FITTINGS

A. Steel Pipe: Fittings manufactured of ductile iron to ASTM A536, Grade 65-45-12. In applicable sizes, fittings shall be short-pattern, with flow equal to standard pattern fittings. Basis of Design: Victaulic FireLock.

B. Couplings: Two ductile iron housing segments, pressure responsive elastomer gasket, and ASTM A449 compliant bolts and nuts.

C. Rigid Type: Housings cast with offsetting, angle-pattern, bolt pads to provide system rigidity and support and hanging in accordance with NFPA-13, fully installed at visual pad-to-pad offset contact. (Couplings that require exact gapping at specific torque ratings are not permitted.). Installation-Ready for complete installation without field disassembly. Basis of Design: Victaulic Style 009N and 107N.

D. Flexible Type: For use in locations where vibration attenuation and stress relief are required: Basis of Design: Victaulic Installation-Ready Style 177 or Style 77.

E. Installation-Ready™ fittings for Schedule [40] [10] grooved end steel piping in fire protection applications sizes NPS 1-¼ thru 2½ (DN 32 thru DN 65). Fittings shall consist of a ductile iron housing conforming to ASTM A-536, Grade 65-45-12, with Installation-Ready™ ends, [orange enamel coated] [red enamel coated] [galvanized]. Fittings complete with prelubricated Grade “E” EPDM Type ‘A’ gasket; and ASTM A449 electroplated steel bolts and nuts. System shall be UL listed for a working pressure of 300 psi (2065 kPa) and FM approved for working pressure 365 psi (2517kPa).

F. Installation-ready gaskets are center-leg, with pipe stop to ensure proper groove engagement, alignment, and pipe insertion depth.

G. Copper Tubing: Fittings shall be wrought copper, ASME B16.22; or cast-bronze, ASME B16.18; with copper-tubing sized grooved ends. (Flaring of tube or fitting ends to accommodate alternate sized couplings is not permitted.) Basis of Design: Victaulic Copper-Connection.

H. Couplings: Two ductile iron housing segments cast with offsetting, angle-pattern, bolt pads, pressure responsive elastomer center-leg gasket, and ASTM A449 compliant bolts and nuts. Installation-Ready for complete installation without field disassembly. Basis of Design: Victaulic Style 607.

2.03 HANGERS, ANCHORS, CLAMPS, AND INSERTS

A. Hangers shall meet NFPA Standards. Provide adjustable swivel rings for piping 3” and smaller.

B. Adjustable clevis hangers for 4” and larger piping. Support piping from building structure, to maintain required grade, and pitch, of pipelines, prevent vibration secure piping in place. Secure hangers to inserts where practical. Hanger rods shall have machine threads.

C. Hanger rods shall be connected to beam clamp, UL Listed concrete inserts or Phillips or approved equal expansion shields. Ramset or power driven inserts will not be allowed.

D. Hanger spacing shall meet requirements of state and local codes.

E. Pipe supports, vertical and horizontal, shall bear on sleeves.

2.04 SPRINKLER HEADS

A. Provide UL-listed and/or FM-approved, sprinkler heads to match existing.

B. Heads shall have ordinary degree temperature ratings, except in areas subject to abnormal heating conditions, where sprinkler heads shall have temperature ratings high enough to prevent discharge. Minimum fusing shall be 165ºF.

C. Sprinkler head with “O” Rings will not be allowed.

D. (If approved by Owner) In lieu of rigid pipe offsets or return bends for sprinkler drops, the Victaulic VicFlex™ Multiple-Use Flexible Stainless Steel Sprinkler Drop System [with captured coupling Style 108] may be used to locate sprinklers as required by final finished ceiling tiles and walls. The drop system shall consist of a braided type 304 stainless steel flexible tube, zinc plated steel Male threaded nipple or Victaulic FireLock IGS Groove Style 108 coupling for connection to branch-line piping, and a zinc plated steel reducer with a female thread for connection to the sprinkler head.

1. The drop shall include a UL approved Series AH1 with 3” bend radius; AH2 or AH2-CC braided hose with a bend radius to 2” to allow for proper installation in confined spaces.

2. Union joints shall be provided for ease of installation.

3. The flexible drop shall attach to the ceiling grid using a one-piece open gate Series AB1 or AB2 bracket. The bracket shall allow installation before the ceiling tile is in place.

4. The braided drop system is UL listed for sprinkler services to 175 psi (1206 kPa) and FM Approved to 200 psi (1380 kPa).

2.05 SPRINKLER CABINET

A. Provide enameled steel sprinkler cabinet with approved number of sprinkler heads as required by NFPA. Provide appropriate sprinkler wrench with each type of head in each cabinet.

2.06 SLEEVES AND PENETRATIONS

A. Pipe Sleeve Materials

1. Sleeves through floors and through exterior, structural and fire-rated construction shall be galvanized Schedule 40 steel pipe.

2. Sleeves through partitions and non-fire rated construction shall be 26 gauge, galvanized steel with lock longitudinal seams, or approved plastic pipe.

3. Metallic Pipe: Provide waterproofing membrane locking devices at floors. Provide 150 lb. Slip-on welding flanges at exterior wall penetrations.

B. Firestop penetration seals in fire-rated construction shall conform to ASTM E814 and shall be ceramic fiber (Proset Systems Firefill); mineral fiber (Manville Thermo-mat); or silicone foam (Dow RTV 3-6548). Provide mineral fiberboard, matting or putty for damming and forming. Finish seals flush to wall surface and fill gaps with silicone adhesive sealant caulking (Dow 96-081 RTV or approved equal). Provide 1" thick ceramic fiberboard on both sides of penetrations in 2- and 3-hour rated walls and floors less than 8" thick. All penetration seals shall be installed in accordance with listing requirements.

C. Packing for sleeves that do not require maintenance of fire rating shall be oakum, silicate foam, ceramic fiber or mineral fiber with approved sealant. Pack or foam to within one inch of both wall surfaces. Seal penetration packing with approved caulking and paintable waterproof mastic surface finish or silicone caulking.

D. Wall and floor penetration firestops shall be UL listed, FM approved.

PART 3 - EXECUTION

3.01 SPECIAL RESPONSIBILITIES

A. Cooperate and coordinate with work of other Sections in execution work of this Section.

B. Verify conditions and take field measurements as required to ensure work shall fit actual conditions. Field corrections to fabricated work and adjustments to adjacent work where required for proper installation of work shall be subject to Architect's approval. Corrections and adjustments shall be permitted only when not detrimental to appearance and function of work.

3.02 SHUT DOWNS

A. Work with Owner in maintaining integrity of new or existing fire protection system. Coordinate and minimize any and all shut downs of fire protection system as follows:

1. Give proper notice to Owner when making shut downs, a minimum of two full weeks.

2. Perform any duties required as by Owner when making a shut down.

3. Fill out a shut down notice form answering all items requested such as time and location of shut down, systems affected, areas affected, etc. when requesting a shut down.

4. Provide fire watch as required during a shut down.

5. Duration of shut downs shall be kept to a minimum.

6. In no case shall the fire protection system be shut down during off hours of workday without a fire watch.

7. System shall be returned to normal operating conditions at end of workday.

3.03 TESTS

A. Test sprinkler system as required by NFPA Code, Fire Underwriters, Factory Mutual and agencies that have jurisdiction.

B. Flush the water main from the point of connection to the municipal system to the system riser at a rate no less than 10 feet per second until water flow is verified to be clear of debris.

C. Test waterflow detecting devices including associated alarm circuits through inspection test connection.

D. Test sprinkler system under pressure of 200 psi or 50 psi above system pressure for two hours. Correct defects and leaks.

E. Provide main drain test.

F. Submit written approval of tests from authorities that have jurisdiction over installation to Owner before Final Acceptance of work.

G. Notify Architect and various departments and bureaus 48 hours before tests are to be made.

H. Operating test of sufficient duration shall be made for systems, equipment, fixtures and accessories to Owner's satisfaction.

I. If inspection or test shows defects, such defective work or material shall be replaced and inspection and tests shall be repeated. Repairs to piping shall be made with new material.

3.04 PIPE IDENTIFICATION

A. Provide color-coded pipe identification markers. Pipe markers shall be snap-on laminated plastic with acrylic coating. Pipe markers shall be applied after Architectural painting.

B. Provide arrow marker with each pipe content marker to indicate direction of flow. If flow can be in either direction, use double-headed arrow marker.

C. Markers shall be Seton Setmark or approved equal.

D. Color banding shall meet latest ANSI and OSHA requirements.

E. Markers shall have legend and with black letters:

Service	Legend	Background Color
Sprinkler	Sprinkler	Red

3.05 ANCHORS AND INSERTS

A. Inserts shall be UL-listed and FM-approved and shall be steel of type to receive machine bolt head or nut after installation. Inserts shall permit adjustment of bolt in one horizontal direction and shall develop strength of bolt when installed properly cured concrete.

B. Provide anchors as necessary for attachment of equipment supports and hangers.

3.06 SPRINKLER INSTALLATION

A. Grooved joints shall be installed in accordance with the manufacturer's latest published instructions. The gasket style and elastomeric material (grade) shall be verified as suitable for the intended service. Gaskets shall be molded and produced by the grooved coupling manufacturer. Grooved ends shall be clean and free from indentations, projections, and roll marks in the area from pipe end to groove. Grooved coupling manufacturer's factory trained field representative shall provide on-site training for contractor's field personnel in the proper use of grooving tools, application of groove, and installation of grooved piping products. Factory trained representative shall periodically visit the jobsite to ensure best practices in grooved product installation are being followed. Contractor shall remove and replace any improperly installed products.

END OF SECTION

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SECTION 230000

HEATING, VENTILATING AND AIR CONDITIONING

PART 1 - GENERAL

1.01 GENERAL CONDITIONS

A. All sections of Division I General Condition requirements shall hereby be made part of this section of the specification.

B. Examine all drawings and all other sections of the specification for the requirements for the work of this section.

C. All work shown in the drawings and specifications shall be included under the base bid, except where there is specific reference to exclusion and incorporation in other quotations.

D. HVAC work is indicated diagrammatically. Exact locations of all components shall be determined in the field and by actual building conditions. Equipment or ducts interfering with other installations shall be relocated as required at no additional cost to the owner.

1.02 DESCRIPTION OF WORK

A. The HVAC scope for this project includes generally, but is not limited to the following:

1. Low pressure ductwork distribution systems
2. Chilled water piping and accessories
3. Hot water piping and accessories
4. Piping insulation systems
5. Ductwork insulation systems
6. Fan Coil Units
7. Rigging
8. Testing and balancing – Air and water systems
9. Automatic Temperature Controls (ATC)

1.03 CODES, PERMITS, AND INSPECTIONS

A. All work shall meet or exceed the latest requirements of all national, state, country municipal and other authorities exercising jurisdiction over construction work of the project.

B. All required inspection certificates shall be obtained, paid for, and made available at the completion of the work. Municipal permit and inspection fees are waived although all applicable permits and inspections are required.

C. Any portion of the work, which is not subject to the approval of an authority having jurisdiction, shall be governed by the applicable sections of the overall National Fire Protection Association.

D. Installation procedures, methods, and conditions shall comply with the latest requirements of the Federal Occupational Safety and Health Act (OSHA).

1.04 GUARANTEES AND CERTIFICATIONS

A. The HVAC contractor shall guarantee work in writing for one year from date of final acceptance against defects in materials, workmanship and installation. The HVAC contractor shall correct defective work at no additional cost to the owner and provide equipment warranties to the owner in full force. Provide five-year warranty for compressors. See product specification paragraphs for more information on warranties.

B. Certification shall be submitted attesting to the fact that specified performance criteria are met by all items of heating and air conditioning equipment.

1.05 SHOP DRAWINGS AND OTHER INFORMATION REQUIRED

A. Prior to purchasing any equipment or materials, six (6) copies of complete submittals shall be submitted for review, including the following minimum information:

1. Drawings, dimensions, and weights.

2. Minimum clearances for proper operation and service.

3. Minimum performance data as required by the drawings and specifications. Submitted information shall include symbols shown on drawing EF-1, RTU-1, etc. The purpose of showing the symbols is identification which specified product is submitted for review. Without proper symbols indicated, the submittals will not be reviewed.

B. Prior to assembling or installing the work, the following shall be submitted for review:

1. Scale drawings showing all piping and duct runs with sizes and elevations shown on composite drawings with indication of coordination with other trades. This submission shall consist of 3 paper prints. If requested by General Contractor, AutoCad files of MEP/FP drawings will be made available for a cost of $50.00 per drawing. Files will be made available after General Contractor signs a WB&A disclaimer provided by WB&A.

2. Catalog information, factory assembly drawings and field installation drawings as required for a complete explanation and description of all items of equipment.

Note: The HVAC contractor shall provide a duplicate copy of the operating manuals for all controls, a duplicate copy of the maintenance manuals for all equipment and controls, and reduced scale drawings showing the HVAC distribution system.

C. It shall be the responsibility of the Contractor to review all drawings and specifications thoroughly during BID process. The contractor shall notify the Engineer/Architect via RFI (request for information) if any conflicts arise. Failure to identify the discrepancies during the BID process shall disqualify the Contractor for claiming any additional compensation.

1.06 SEPARATION OF WORK BETWEEN TRADES

A. The following items shall be furnished and installed by the HVAC contractor:

1. Motors for mechanical equipment
2. Controls for mechanical equipment
3. Hoisting and rigging
4. Fastenings and supports
5. Roof opening flashing
6. Field touch up painting of damaged shop coats
7. Rubbish removal

B. The following items shall be furnished and installed by other trades:

1. Cutting of openings in floor, walls and roof
2. Louvers in outside walls and roof vents
3. Enclosure/shafts of ducts
4. Piping enclosures
5. Concrete pads for equipment
6. Power for HVAC equipment

C. The Heating, Ventilating and air Conditioning Trade is required to supply all necessary supervision and coordination information to any other trades who are to supply work to accommodate the Heating, Ventilating and Air Conditioning installations.

1.07 EQUIPMENT AND MATERIALS

A. All equipment and materials shall be new and without blemish or defect.

B. It is the intent of these specifications that wherever a manufacturer of a product is specified, and the terms “other approved” or “or approved equal” or “equal” are used, the substituted item must conform in all respects to the specified item.

C. Substituted equipment or optional equipment where permitted and approved, must conform to space requirements. Any substituted equipment that cannot meet space requirements, whether approved or not, shall be replaced at the Contractor's expense. Any modifications of related systems as a result of substitutions shall be made at the Contractor's expense.

1.08 INTERPRETATION OF THE DRAWINGS AND SPECIFICATIONS

A. As used in the drawings and specifications for this work, certain non-technical words shall be understood to have specific meanings as follows regardless of indications to the contrary in the general conditions or other documents governing the work.

"Furnish" Purchase and deliver to the project site complete with every necessary appurtenance and support, all as part of this work. Purchasing shall include payment of all sales taxes and other surcharges as may be required to assure that purchased items are free of all liens, claims or encumbrances.

"Install" Unload at the delivery point at the site and perform every operation necessary to establish secure mounting and correct operation at the proper location in the project, all as part of this work.

"Provide" "Furnish" and "Install".

"New" Manufactured within the past two years and never before used.

B. Except where modified by a specific notation to the contrary, it shall be understood that the indication and/or description of any item in the drawings or specifications for this work carries with it the instruction to furnish, install and connect the items as part of the work, regardless of whether or not this instruction is explicitly stated.

C. To the extent that they govern the basic work, the specifications also govern change order work.

D. No exclusion from, or limitation in, the symbolism used on the drawings for this work or the language used in the specifications for this work shall be interpreted as a reason for omitting the appurtenances or accessories necessary to complete any required system or item of equipment.

E. The drawings for this work utilize symbols and schematic diagrams which have no dimensional significance. The work shall, therefore, be installed to fulfill the diagrammatic intent expressed on the drawings, but in conformity with the dimensions indicated on the final working drawings; field layouts and shop drawings of all trades.

F. Certain details appear on the drawings for this work which are specific with regard to the dimensions and positioning of the work. These are intended only for general information purposes. They do not obviate field coordination for individual items of the indicated work.

G. Information as to general construction and architectural features and finishes shall be derived from structural and architectural drawings and specifications only.

H. The use of words in the singular shall not be considered as limiting where other indications denote that more than one item is referred to.

1.09 COORDINATION

A. Work shall be performed in cooperation with other trades on the project and so scheduled as to allow speedy and efficient completion of the project.

B. This Contractor shall furnish to other trades advance information on locations and sizes of all frames, boxes, sleeves, and openings needed for his own work, and also furnish information and shop drawings necessary to permit trades affected by this Contractor's work to install their work properly and without delay.

C. Where there is evidence that work of this Contractor will interfere with the work of other trades, this Contractor shall assist in working out space conditions to make satisfactory adjustments.

D. This Contractor shall, with the approval of the Engineer and without extra cost to the Owner, make modifications in his work as required by structural interference. This Contractor shall pay all expenses to the General Contractor for additional openings, or relocating or enlarging existing openings through concrete floors, walls, beams and roof required for this work which was not properly coordinated.

E. If this Contractor installs his work before coordinating with other trades so as to cause interference with the work such trades, he shall make all necessary changes in his work to correct the conditions without extra cost to the Owner.

F. This Contractor shall visit the site to ascertain and apprise himself of the actual field conditions under which the work has to be performed. All work shown on the drawings is diagrammatic in nature and their actual location and elevation shall be verified in the field. Any deviations necessary as a result of field interferences shall be brought to the attention of the Engineer and resolved expeditiously, at no additional cost to the Owner.

G. The Contractor shall protect all materials and work of other trades form damage that may be caused by his work and shall be responsible for repairing any damages without extra cost to the Owner.

H. Sleeves, inserts, anchor bolts and similar items set into the masonry structure or the work of other trades shall be furnished and installed by this Contractor. This Contractor shall be responsible for all such items necessary to hanged or support his equipment.

I. When, in order to accommodate this Contractor's work, finished materials and work of other trades must be cut or fitted in the shop this Contractor shall furnish the necessary drawings for transmittal to the trades whose materials must be cut or fitted.

J. Cutting, coring, drilling and patching of holes and openings for the work of sub-trades shall be performed by the particular subcontractor when the largest dimension of the opening is less than 4.5 inches. If the largest dimension of the opening is 4.5 inches or more, the General Contractor shall perform the cutting and patching for the work of the subcontractor. For cutting and patching see Section 01045.

K. Exact location of diffusers, grilles and thermostats shall be approved by the architect before their installation. See architect’s drawings for more information.

L. All piping and ductwork shall be insulated as per code. Weather proof material over the insulation shall be provided on components exposed to outside

M. All work shall be installed so that parts requiring periodic inspection, operation, maintenance and repair are readily accessible. Minor deviation from the drawings may be made to accomplish this, but changes of substantial magnitude shall not be made prior to written approval from the Engineer. The contractor shall determine locations of all access panels required for the project. Locations shall be coordinated with the General Contractor and approved by the Architect. Access panels shall be furnished by HVAC trade and installed by General Contractor.

PART 2 - PRODUCTS

2.01 PIPING AND FITTINGS

A. General

1. Pipe materials and fitting materials shall be as indicated in Schedule of Pipe and Fitting Materials. Provide dielectric fitting to connect different piping materials.

2. Steel piping 2-1/2" and larger and all direct-buried piping shall be welded; 2" and smaller (except direct buried piping) shall be screwed. Steel piping shall be seamless or electric-resistance welded ASTM A53, Grade B.

3. Use Schedule 80 for welded piping and fittings 2" and smaller.

4. Pipe take-offs shall have no less than three elbow swings.

B. Special Requirements for Water

1. Provide air vent at each high point and drain valve at each low point for complete system drainage.

2. Provide flow measuring devices, balancing cocks at each system loop return, and shut-off valves at each system loop supply.

3. Equipment condensate drains shall be trapped at equipment connection. Drain lines shall run full size of drain tapping to nearest floor drain or as shown on Drawings with a pitch of 1" in 20 feet.

4. Pitch water piping upwards and condensate pump discharge downward in direction of flow 1" in 40 feet, unless otherwise noted.

C. Special Requirements for Steam

1. Pitch steam condensate downward in direction of flow 1" in 10 feet, unless otherwise noted.

2. Pitch steam piping downward in direction of flow 1" in 40 feet, unless otherwise noted.

D. Special Requirements for Fuel Oil

1. Provide a full flow duplex oil strainer in any fuel oil supply line serving an oil burning appliance (burner, generator, water heater or any other appliance). Strainer shall be located upstream of any automatic or manual valves in order to protect the valves.

2. See requirements for cathodic protection of underground fuel oil lines further on in this specification.

E. Schedule of Pipe and Fitting Materials

SERVICE	PIPE MATERIAL WEIGHT	FOR TYPE OF JOINTS	FITTING MATERIAL	PRESSURE RATING PSI OR WEIGHT
CHILLED/HOT WATER	STEEL SCHEDULE 40	SCREWED	MALLEABLE IRON	150
CHILLED/HOT WATER	STEEL SCHEDULE 40	WELDED OR VICTAULIC	STEEL	SCHEDULE 40
CONDENSER WATER	STEEL SCHEDULE 40	SCREWED	MALLEABLE IRON	150
CONDENSER WATER	STEEL	WELDED OR VICTAULIC	STEEL	SCHEDULE 40
FUEL OIL INSIDE BUILDING	STEEL SCHEDULE 40	SCREWED	MALLEABLE IRON	150
FUEL OIL UNDERGROUND	STEEL SCHEDULE 40	WELDED	STEEL	SCHEDULE 40
CONDENSATE DRAIN	COPPER TYPE L	SOLDERED	WROUGHT COPPER	125
COLD WATER	COPPER TYPE L	SOLDERED OR PRO-PRESS	WROUGHT COPPER	125
REFRIGERANT	COPPER TYPE ACR	BRAZED OR ZOOM-LOCK	WROUGHT COPPER	200
VENTS	GALVANIZED STEEL SCHEDULE 40	SCREWED	MALLEABLE IRON	150
STEAM (HP)	STEEL SCHEDULE 80	SCREWED	MALLEABLE IRON	300
STEAM (HP)	STEEL SCHEDULE 80	WELDED	STEEL	SCHEDULE 80
STEAM (LP)	STEEL SCHEDULE 40	SCREWED	MALLEABLE IRON	150
STEAM (LP)	STEEL SCHEDULE 40	WELDED	STEEL	SCHEDULE 40
STEAM CONDENSATE	STEEL SCHEDULE 80	SCREWED	MALLEABLE IRON	300
EMERGENCY GENERATOR EXHAUST	BLACK STEEL SCHEDULE 40	WELDED	BLACK STEEL	SCHEDULE 40

F. Connections

1. Provide dielectric fittings at connections of dissimilar materials.

2. Provide eccentric reducing couplings to bring pipes flush on top for water service and flush on bottom for steam service.

3. Branch lines in welded piping shall be made with welding tees except that branch lines less than one-half diameter of main may be made with Weld-O-Lets.

4. Nipples shall be same material, make and thickness as pipe with which they are used. Close nipples shall not be used.

5. Make piping connections 2-1/2" diameter and larger to valves and equipment with flat face welding neck flanges.

6. Make piping connections 2" diameter and smaller to valves and equipment with 300 psi brass seat unions on steel piping and with heavy semi-flushed brass unions on copper tubing.

7. Fit flanged joints with Johns-Manville or approved equal ring gaskets. Flanges shall be faced and drilled to ASA standards and fitted with semi-finished hexagon machine bolts and nuts of proper number and size.

8. Make screw joints tight with Teflon (polytetrafluoroethylene) tape or litharge-glycerin mixture applied to male threads. Use tapered threads.

9. Make fusion welded joints as required by ANSI B31.1. Make changes in direction of pipe with welded fittings only. Bevel connections before welding, mechanically or by flame-cutting.

G. Emergency Generator Exhaust

1. Install emergency generator exhaust muffler and flanged flexible connections furnished under Electrical section.

2. Provide exhaust piping as specified, as shown on Drawings and as required by applicable codes and standards. Provide 90-degree long-radius sweep elbows as necessary.

H. Cathodic Protection

1. Provide a system of cathodic protection to protect all underground steel fuel oil piping. It shall be the contractor’s responsibility to secure the services of a registered professional engineer in the field of corrosion protection to design and detail specific requirements of the project.

2. Products and requirements for the protection system shall be as set forth by the corrosion engineer. Installation of system shall be as required by corrosion engineer in accordance with equipment manufacturer's published installation instructions, and with recognized industry practices.

3. Cathodic protection product submittal shall be stamped with the seal of corrosion engineer and signed by him. Submittal shall include, but not be limited to, construction details of cable connections to piping and other field connections, test station details, methods of coating and wrapping pipes, complete wiring diagram of system and maintenance instructions. Provide site plan showing runs of piping to be protected, test station locations and sacrificial anode locations.

2.02 VALVES AND STRAINERS

A. Valves on condenser water, chilled water, hot water and fuel oil services shall be 125 psi unless noted otherwise. Pressure ratings of valves for steam and condensate services shall be as specified. Provide balancing valves where shown on drawings and where required to balance the systems.

B. Valves shall have name of manufacturer and guaranteed working pressure cast or stamped on bodies. Valves of similar type shall be by single manufacturer: Jenkins, Crane, DeZurik, Walworth, Posi-Seal high performance, Keystone, Apco, Mueller, Rockwell, Watts or Cannon. Provide chain operators for valves 7 feet and higher above floor. Figure numbers specified are intended to establish standard of quality, performance and materials.

C. Provide butterfly valves for shutoff and balancing on chilled, hot and condenser water services 2-1/2" and larger. Provide balancing stop on at least one valve per equipment connection and as necessary for balancing services.

1. High performance valves rated 285 psi maximum working pressure shall be carbon steel body, threaded-lug with reinforced Teflon seats, 316 stainless disc and 17-4 stainless stem, by Posi-seal, Rockwell, Keystone or Flowseal.

2. Valves rated 175 psi maximum working pressure shall be iron body, threaded-lug with resilient EPDM seats, bronze disc and 416 stainless stem, by Keystone (Fig. 228), DeZurik (Fig. 660), Mueller or Centerline.

3. Valves 6" and larger shall have gear or chain operators.

4. Valves smaller than 6" shall have seven-position lever operators.

5. Test valves at 110% of rated pressure.

D. Provide bronze-body ball valves with reinforced Teflon seats, seals, bearings and packing. Ball valves shall be used for chilled, hot and condenser water services in sizes 2" and smaller. Provide balancing stop on at least one valve per equipment connection and as necessary for balancing service. Valves shall be Apollo Series 70, Cannon Series 31, Rockwell M202 or Watts B6000. Valves shall be rated 600 psi wog.

E. Provide globe valves for balancing and throttling steam and medium pressure condensate services as follows:

1. Valves 2-1/2" and larger shall be iron body, flanged ends, bronze mounted, outside screw and yoke, renewable seat.
2. Valves 2" and smaller shall be bronze body, screwed ends, bronze trim, rising stem.

3. Globe valves shall be as follows:

a. Threaded, bronze, composition disc, Jenkins Fig. 106-A, suitable for 150 psi saturated steam.
b. Flanged, iron body bronze-mounted, composition disc, outside screw and yoke, Jenkins Fig. 142, suitable for 125 psi steam.
c. Flanged, iron body, bronze-mounted, bronze disc, outside screw and yoke, Jenkins Fig. 923 suitable for 250 psi steam.

F. Provide iron body permanently lubricated eccentric plug valves for balancing on services 2" and smaller. Valves shall be rated at 175 lb. WOG. Valves shall be by single manufacturer: Walworth, DeZurik, Mueller (Fig. 118S) or Rockwell. Provide adjustable

memory stop and dri-proof shut-off to full pressure rating.

G. Check valves sized 2-1/2" and larger shall be iron body, flanged ends, bronze mounted, swing pattern. Check valves 2" and smaller shall be bronze, screwed ends, swing pattern. Check valves for chilled water and condenser water pump discharge shall be spring loaded, globe type, silent check, by APCO, Mueller or Jenkins.

H. Relief valves shall be brass with external lever, ASME-approved. Pipe discharge to floor drain with open connection at floor. Pipe chiller refrigerant relief devices through roof to atmosphere.

I. Provide gate valves for shut-off on steam and steam condensate services as follows (All figure numbers are Jenkins).

1. 125 psi steam working pressure valves shall be iron bodies, and silicon brass stems. Valves 3" and smaller shall have solid bronze wedges, Valves larger than 3" shall have solid iron wedges with bronze face rings. Non-rising stem, inside screw valves 2-1/2" and under shall be threaded Figure 325, valves 3" and over shall be flanged Figure 326. Rising stem, outside screw and yoke valves 2-1/2" and under shall be threaded figure 650-A valves 3"-12" shall be Figure 651-A.

2. 250 psi steam working pressure valves 2"-4" shall be flanged figure No. 203 with silicon brass stems, solid bronze wedges for valves 3" and under and iron with bronze face rings for 4" valves. Valves shall have non-rising stems. Valves 5"-12" shall be flanged Figure No. 204 outside screw and yoke, rising stems with wedges and stems as Figure 203.

J. Strainers

1. Strainers 2" and smaller shall be 250 lb. bronze body, stainless steel, screen with 20 mesh screen opening, Y-pattern, screwed ends, Sarco Type BT, Mueller, Watts or Armstrong.

2. Strainers 2-1/2" and larger shall be 125 lb., cast iron body, stainless steel screen with manufacturer's recommended screen openings, Y-pattern, flanged, Sarco Type AF-125 or equivalent by Mueller, Watts or Armstrong. Chilled water strainers shall be 250 lb. cast iron body, Sarco Type AF-250 or equivalent by Mueller, Watts or Armstrong.

3. Provide blow-off valve on each strainer.

4. Pump suction strainers 2" and smaller shall have 0.062 screen openings. Pump suction 2-1/2" and larger shall have 0.125 screen openings.

5. Strainer gaskets shall not contain asbestos.

K. Provide threaded vacuum breakers with ball, spring, O-ring flexible seat, and screen. Ball shall be 440 stainless steel; seat shall be EPR. Spring shall be 316 stainless steel; screen and cap shall be 304 stainless steel and threaded collar shall be 416 stainless steel. Body shall be brass. Vacuum breakers shall be Johnson Series VB8 size 1-1/4 IPS, or equivalent by Watts or ITT Hoffman.

L. Provide unions for threaded end valves to facilitate removal from pipe.

M. Automatic Flow Control Valves

1. Provide automatic pressure compensating flow control valves by Griswold, Armstrong, or Autoflow where indicated on the drawings. Valves shall have the capabilities and pressure differential characteristics, as indicated, and conform to the following required for control.

2. Valves shall be factory set and shall automatically limit the rate of flow to required engineered capacity within approximately 5% accuracy over an operating pressure differential of at least 14 times the minimum required for control.

3. The control mechanism of the valve shall consist of self-contained, open-chamber cartridge assembly with unobstructed flow passages that eliminate accumulation of particles and debris. All internal working parts shall be stainless steel or nickel plated brass. Body shall be ductile iron, cast iron or bronze.

4. The cartridge assembly shall consist of a spring-loaded cup. The cup shall utilize the full available differential pressure across the valve to actuate the cup and, thereby, reduce friction and hysteresis and eliminate binding.

5. Valves shall be available in minimum of three pressure differential ranges, with the minimum range requiring less than 2 PSIG to control flow. Valve bodies shall be provided with inlet and outlet tapping suitable for connection of instruments for verification of flow rates and temperature and shall be marked to show direction of flow. Valve bodies shall be rated for use at not less than 150% of system designed operating pressures.

6. Certified performance data for the flow control valve, based on independent laboratory tests, supervised and witnessed by a registered professional engineer, shall be available.

7. All flow control valves shall be supplied by a single source responsibility.

8. Each automatic flow control valve shall be furnished with a valve kit consisting of 1/4" x 2" minimum size nipples, quick-disconnect valves (to be located outside of insulation), and fittings suitable for use with the measuring instruments specified, as well as temperature.

9. Provide a metal identification tag, with chain, for each installed valve. The tag to be marked with zone identification, valve model number and rated flow in GPM.

10. Flow control valve shall be warranted for period of five years from date of start-up.

11. Provide owner with dual hose meter kit including pressure gauge with 4-1/2" dial, 3-way push button operated valve, 5' long dual connection hoses, dual shutoff and vent valves, dual special valves for connection to standard valve kit, flow conversion chart and carrying case.

N. Suction Diffusers

1. Suction diffuser/strainers shall be 200 psi cast iron body, stainless steel screen with 1/16" screen opening, flanged, Mueller type 1011, Taco or B&G. Provide fine mesh start-up screens.

2. Provide blow-off tapping on bottom of unit.

3. Provide blow-off valve on each strainer.

2.03 PIPE INSULATION

A. Insulation on indoor piping shall be 5 lb./cf nominal fibrous glass insulation with factory-applied fire retardant vapor barrier jacket with K factor of 0.21 at 75 degrees F. mean temperature by Owens Corning, Certain-Teed, Manville or Knauf, installed as required by manufacturer. ASTM E-84 fire hazard ratings shall be 25 flame spread, 50 smoke developed and 50 fuel contributed. Use cellular glass “Foamglass” on outdoor piping.

B. Apply insulation after systems have been tested, proved tight and approved by Architect. Remove dirt, scale, oil, rust and foreign matter prior to installation of insulation.

C. No leaks in vapor barrier or voids in insulation will be accepted.

D. Insulation and vapor barrier on piping which passes through walls or partitions shall pass continuously through sleeve, except that piping between floors and through fire walls or smoke partitions shall have space allowed for application of approved packing between sleeves and piping, to provide fire stop as required by NFPA. Seal ends to provide continuous vapor barrier where insulation is interrupted.

E. Insulate flexible connections to same thickness and with same material as adjoining pipe insulation.

F. Provide fibrous dual temperature insulation with factory applied vapor barrier jacket on steam, outdoor condenser water, outdoor cooling tower drain and makeup, condensate, chilled water, drain, hot and cold water piping, except as specified otherwise.

G. Drain piping, other than PVC piping, shall have ½" thick insulation. Insulation thickness for indoor steam, steam condensate, chilled water, hot water and cold water piping shall be as follows:

TABLE A – MINIMUM PIPE INSULATION THICKNESS (Per ASHRAE Standard 90.1-2016)

PIPING SYSTEM TYPE	FLUID TEMP. RANGE F.	1.25" & LESS	1.5” to 3.0”	4” & LARGER	INSULATION CONDUCTIVITY AT TEMP F.
STEAM, STEAM CONDENSATE, HEATING HOT WATER, AND DOMESTIC HOT WATER	251-350	4.0	4.5	4.5	0.29 – 0.32 @ 200
	201-250	2.5	2.5	3.0	0.27 – 0.30 @ 150
	141-200	1.5	2.0	2.0	0.25 – 0.29 @ 125
(NOTE: DOUBLE THE THICKNESS FOR OUTDOOR PIPING)	105-140	1.0	1.5	1.5	0.22 – 0.28 @ 100

CHILLED WATER REFRIGERANT/BRINE *(NOTE: DOUBLE THE THICKNESS FOR OUTDOOR CHILLED WATER PIPING)*	40-60 BELOW 40	0.5 1.0	1.0 1.0	1.0 1.0 (1.5" thick @ 8" dia. & ABOVE)	0.21 – 0.27 @ 75 0.20 – 0.26 @ 50

H. Provide longitudinal lap and 6" wide vapor barrier joint seal strips secured with approved adhesive.

I. Seal ends of pipe insulation and seal insulation to pipe with approved fire retardant vapor barrier, at flanges, valves and fittings and at intervals of no more than 21 feet on continuous runs of piping.

J. Secure covers on concealed pipe with metal bands at least 3/4" wide and no more than 18" apart, spaced to hold ends and centers of each section.

K. Insulation on all outdoor chilled water, condenser water, cooling tower drain, and makeup water piping shall be 2" "Foamglas". Waterproof with 0.016" thick aluminum jacket with 2" transverse and longitudinal lapped seams oriented to shed water. Fill seams with weatherproof adhesive. Secure jacket with 1" wide aluminum draw-bands on 12" centers.

L. Indoor condenser water supply piping, for free cooling heat exchanger systems, shall be insulated from the building boundary to the inlet of the free cooling heat exchanger. Insulation shall be 1.5" fiberglass.

M. Insulation on Fittings, Valves, and Flanges

1. Fittings, valves and flanges shall be insulated with pre-cut, factory-supplied fibrous glass, by Certain-Teed, Knauf, Owens Corning or Manville.

2. Fittings, valves and flanges shall be insulated with same material and to same thickness as adjoining pipe insulation.

3. Pipe fittings shall be pre-tested, clean and dry before insulation.

4. Installation of insulation on fittings shall be as follows, in order:

   a. Wrap insulation around fitting and tuck ends into fitting throat.
   b. Edges of adjacent insulation shall be tufted and tucked in, to fully insulate fitting to thickness of adjacent pipe insulation. Use two or more thickness is necessary.
   c. If two layers of insulation are used on fittings, wrap and secure first layer with twine before applying second layer.
   d. Top layer of insulation shall be covered with one piece, PVC, molded jacket cover. Secure cover with stainless steel tack fasteners inserted into jacket throat overlap seam.
   e. Tape joints with pressure-sensitive vapor barrier tape; tape shall extend 2" on either side of joint.

5. Prior to taping of joints on chilled water and condenser water lines, apply vapor barrier mastic (brushed on) to fitting cover, throat overlap and edges. Also apply vapor barrier mastic to pipe insulation jacket ends.

N. Insulation for fittings, valves and flanges shall be mitered pipe insulation or molded fittings as follows:

Piping	Requirements
Concealed	Molded fittings made smooth with insulating cement. 8 oz. canvas jacket saturated with approved lagging adhesive.
Exposed	With 1/4" coat of insulating cement over insulation, trowelled smooth. 8 oz. canvas jacket saturated with approved lagging adhesive.
Underground/ Outdoors	Weatherproof, with two 1/8" wet coats of breather type mastic, reinforced with glass fabric extending 2" onto either side of adjacent insulation.

O. Refrigeration Line Insulation

1. Suction lines and outdoor liquid lines shall be insulated with 1” thick rigid closed cell foam insulation, Armstrong Rigid Armaflex, Manville, Owens Corning or Halstead/Nomaco (Insultube), except in computer room plena.

2. Installation shall meet manufacturer's recommendations. Seal butt joints with insulation manufacturers approved adhesive.
3. Outside above ground insulation shall be protected with two coats of approved vinyl lacquer coating over woven glass mesh adhered to insulation with Insulcolor or approved equal lagging adhesive, as recommended by manufacturer.

4. Refrigerant piping in hung ceiling and underfloor supply and return plenums shall be insulated with 1" thick fibrous glass insulation that meets applicable requirements of this Paragraph.

P. Emergency Generator Exhaust

1. Insulate emergency generator exhaust piping, fittings and muffler with two, 2" layers of calcium silicate with staggered joints (4” total). Secure with ½" wide 0.015" thick galvanized steel bands on 12" centers.

2. Insulation shall be rated for maximum operating temperature of 1200 degrees F. Point up joints with insulating cement.

3. Apply 1" hexagonal mesh over insulation, lacing edges together, and ½" thick coat of insulating cement troweled smooth.

4. Apply fibrous glass cloth jacket and size with one brush coat of lagging adhesive.

2.04 PIPE HANGERS AND SUPPORTS

A. Provide pipe stands, supports, hangers and other supporting appliances as necessary to support work required by Contract Documents.

B. Secure vertical piping to building construction to prevent sagging or swinging.

C. Space hangers for horizontal piping as follows:

PIPE SIZE	ROD DIAMETER	MAXIMUM SPACING
Up to 1-1/4"	3/8"	8'- 0"
1-1/2 and 2"	3/8"	10'- 0"
2-1/2 and 3"	½"	10'- 0"
4 and 5"	5/8"	12'- 0"
6"	3/4"	12'- 0"
8" and over	7/8"	12'- 0"

Horizontal copper tubing shall have maximum hanger spacing of 6' for tubing 1-1/4" dia. and smaller and 10' for tubing 1-1/2" and larger. Maximum spacing for PVC pipe hangers shall be 4'.

D. Reduce spacing to a maximum of 10' - 0" apart, regardless of pipe size, as necessary for fittings, valves and other concentrated loads.

E. Support piping 3" dia. and larger from structure with pipe roll hangers with adjustable steel rod hangers, sized to accommodate insulation.

F. Support piping 2-1/2" dia. and under from structure with Carpenter and Patterson Fig. 100 clevis hangers or approved equal, with one ½" adjustable steel rod; or, from side wall by expansion shields, angle iron brackets and rods.

G. Hangers shall be by Carpenter & Patterson, F & S, or Grinnell Co. Figure numbers of Carpenter and Patterson are specified to establish standards of quality for performance and materials.

H. Provide spring hangers with travel stops as specified in Vibration Isolation Paragraph where necessary and where shown on Drawings.

I. Pipe supports for insulated high-temperature piping shall have welded inserts of equal thickness to insulation to prevent compression of insulation. Other insulated pipe shall have 10" shields at hangers, composed of 180 degree coverage of galvanized sheet metal and high density, pre-formed, rigid insulation. Where rollers are required, shield shall be steel pipe.

J. Hangers for horizontal lines shall be vertically adjustable to obtain pitch requirements of Piping Paragraph.

2.05 SLEEVES AND PENETRATIONS

A. Pipe Sleeves

1. Sleeves through floors and through exterior, structural and fire-rated construction shall be hot-dipped galvanized Schedule 40 steel pipe.

2. Sleeves through partitions and non-fire-rated construction shall be 26 gauge galvanized steel with lock longitudinal seams, or approved plastic pipe.

3. Provide waterproofing membrane locking devices at floors. Provide 150 lb. slip-on welding flanges at exterior wall penetrations.

B. Duct Sleeves and Openings

1. Sleeves through floors, through exterior structure, through fire-rated construction and through smoke partitions that require smoke dampers shall be Schedule 40 galvanized steel pipe for round duct and shall meet SMACNA Fire Damper and Heat Stop Guide for rectangular and flat oval ducts. Fireproof packing shall be applied to seal any openings between sleeve and wall. Materials shall maintain the fire rating of the wall, and shall be installed in accordance with the SMACNA Fire Damper and Heat Stop Guide.

2. Openings in walls, partitions and other fire-rated construction that do not require smoke dampers shall meet NFPA 90A, Section 3-3.8.

3. Materials for prepared openings in partitions shall match construction penetrated.

C. Pipe Sleeve Packing

1. Packing between the pipe and the sleeve (or wall or slab opening) in fire rated walls or slabs shall be a combination of fireproof insulation and fireproof caulk. The combination of materials shall have the same fire rating, in hours, as the wall or slab, as tested in accordance with the latest edition of ASTME-119. The combination of materials shall be classified by UL, (fill, void or cavity materials) for the fire rating required and shall be listed as a numbered system in the UL Building Materials Directory. Fiberglass shall not be used as the insulation material.

2. Acceptable fireproof insulation materials shall be Kaolin (Kaowool by Babcock and Wilcox); ceramic fiber blanket (Fiberfrax by Standard Oil) or fire rated mineral wool (Thermafiber by USG). Acceptable fireproof caulks shall be Silicone (Firestop by Dow Corning); ceramic fiber (Fyreputty by Standard Oil) or intumescent synthetic elastomer (Fire Barrier Caulk by 3M)

3. Packing for sleeves that do not require maintenance of fire rating shall be oakum, silicate foam, ceramic fiber or mineral fiber with approved sealant. Pack or foam to within 1" of both wall surfaces. Seal penetration packing with approved caulking and paintable waterproof mastic surface finish or silicone caulking.

4. All materials must be installed in accordance with manufacturer's instructions; all gaps must be sealed. Finish caulk flush with wall or slab surface if piping runs exposed.

D. Other Waterproof Pipe Penetrations

1. Modular mechanical penetration seals shall be interlocking synthetic rubber links shaped to fill annular space continuously, with galvanized carbon steel bolts, nuts and pressure plates to expand rubber seal between pipe and sleeve. Sleeve seal shall be watertight.

2. Prefabricated modular sleeves shall be Mason Industries (SWS) or approved equal stiffened galvanized steel sleeves with preformed closed-cell elastomeric seal (non-fire-rated) or preformed mineral fiber or silicone foam seal (fire-rated).

3. Provide waterproof 1" single ring set in silicone and bolted to floor or wall at chipped and drilled penetrations of existing slabs on grade and existing walls below grade.

2.06 WATER SPECIALTIES

A. Provide water specialties by Bell & Gossett, Taco or Amtrol as follows:

1. ASME constructed, approved and stamped diaphragm expansion tank with replaceable diaphragm of capacity shown on Drawings designed and tested for maximum allowable working pressure of 125 psi in accordance with ASME code for unfired pressure vessels. Expansion tank shall be factory-charged as required for system.

2. One drain valve for each expansion tank.

3. Automatic air vent with manual shut-off for each high point on supply and return mains with ¼"copper overflow run to nearest plumbing fixture for drainage.

4. Air separators for chilled, condenser and hot water systems by Bell & Gossett (Rolairtrol), Taco or Amtrol.

5. Air vent valve installed on each piece of equipment.

6. Drain valve at each low point with ¾" brass heads with hose connections.

2.07 PRESSURE GAUGES, THERMOMETERS, AND TEST PLUGS

A. Provide bronze Bourdon tube pressure gauges where shown on Drawings and/or where specified, by U.S. Gauge, Trerice, or Weksler, accurate to approximately 1%.

1. Gauges shall have white faces with black-filled engraved lettering. Gauge bodies shall be set in phenolic cases. Provide siphons and shut-off cocks.

2. Gauges hall be easily accessible and easily read. Gauges readable from floor at less than five feet shall have 4-1/2” dials. Other gauges shall have 6” dials. Gauges graduations shall meet limit requirements of normal operation. Gauge shall indicate at mid-scale.

B. Provide separable well V-case thermometers by U.S. Gauge, Trerice, or Weksler where shown on Drawings and where specified. Thermometers shall have 9” scale and white face with black-filled engraved letters. Thermometers shall be angular or straight stemmed, as conditions necessitate. Thermometer wells shall be bronze and shall be installed so as to ensure minimum restriction of water flow in pipe.

1. Provide thermometer ahead of and beyond cooling coils, in pump suctions and discharges, and where shown on Drawings. Thermometers shall have scale range of 0 degrees - 120 degrees F. with 2-degree scale division.

2. Provide thermometer in condenser water system at each chiller, cooling tower and pump connection. Scale range shall be 20 degrees - 180 degrees F. with 2” scale division.

3. Provide thermometer in hot water system at each boiler, coil and pump connection, unless specified otherwise. Scale range shall be 30 degrees - 300 degrees F. with 2-degree scale division.

4. Provide additional thermometers where shown on Drawings.

C. Combination Temperature Pressure Test Plugs

1. Provide, where shown on details, combination pressure temperature test plugs by Peterson Equipment Company “Petes Plug” or Sisco, Inc. “P/T Plugs”.

2. Plug shall be ¼” or ½” NPT, constructed of solid brass with a Nordel valve core suitable for temperatures up to 350 degrees F. Plug shall be rated zero leakage from vacuum to 1000 psig.

3. Provide extension fitting for each plug suitable for use with 2” maximum pipe insulation.

4. Provide gauge test kit consisting of the following items:

a. (2) 3-1/2” dial face gauges 0-100 psi and 0-231 feet.
b. (2) Gauge adaptors with 1/8” O.D. probe.
c. (2) 5” stem pocket testing thermometers ranges 25-125 degrees F; 0 degrees - 220 degrees F.
d. (1) Carrying case.
e. (2) 4' length of flexible hose with adaptors.

2.08 FLOW ELEMENTS

A. Provide flow measuring elements on all return piping take-offs and all equipment with coils including air handlers, unit and cabinet unit heaters.

B. Install elements as required by manufacturer.

C. Flow elements shall be TACO “ACCU-FLO” or approved equal.

2.09 SHEET METAL DUCTWORK

A. Reference Standards

1. Material, construction and installation shall meet requirements of most recent editions of the following standards and references, except for more stringent requirements specified or shown on Drawings.

Standard	As Applicable to
SMACNA HVAC Duct Construction Standards (Metal and Flexible)	Sheet Metal Ductwork; Duct Liners; Adhesives; Fasteners; Flexible Ductwork
SMACNA HVAC Air Duct Leakage Test Manual	Duct Leakage Testing
NFPA 90A	Fire Dampers; Fire Resistance Standards for Ducts and Liners
SMACNA Guidelines for Welding Sheet Metal	Welded Galvanized, Black Iron and Stainless Steel Ductwork

B. General

1. Provide supporting and hanging devices necessary to attach entire HVAC system including ductwork and equipment, and to prevent vibration.

2. Provide vertical and horizontal supports as required by codes to meet minimum applicable earthquake resistance standards.

3. Ductwork shall be free from vibration under all conditions of operation.

4. Dimensions shown on Drawings for lined ductwork are net inside dimensions. Increase ductwork to accommodate lining requirements.

5. Pipe or conduit crossing duct

a. No pipe, conduit, hanger, Architectural element nor structural member shall pass through duct without Architect's written approval.
b. Where it is impossible to re-route pipe or conduit and when written approval has been obtained, increase duct size to maintain constant cross-sectional area at point of interference. Provide streamlined enclosure for pipe or conduit, as illustrated in SMACNA.

6. When making offsets and transformations necessary to accommodate structural conditions, preserve full cross-sectional area of ductwork shown on Drawings.

7. Ductwork Construction

   a. All ductwork systems shall be constructed and sealed in accordance with SMACNA standards for the specified pressure-velocity classifications.
   b. Ductwork systems shall have pressure-velocity classifications as follows:

Duct System	Material	SMACNA Pressure Class	Press	SMACNA Seal Class	Velocity (FPM)	Method of Construction
Induction unit air distribution systems	Spiral Steel	10”	Pos	A	>2000	Welded
VAV Supply ductwork downstream of air handlers	Galvanized Steel	4”		A	<4000	
Supply ductwork for low pressure systems and downstream of VAV terminal	Galvanized Steel	2”	Pos	B	<2500	
Return air ductwork for low pressure systems	Galvanized Steel	2”	Neg	B	<2500	
General low pressure exhaust ductwork	Galvanized Steel	2”		B	<2500	
Toilet exhaust ductwork	Galvanized Steel	2”		B	<2500	
Dryer exhaust ductwork	Aluminum	2”		B	<2500	
Commercial kitchen exhaust	Black iron	6”	Neg	A	>2000	Welded
Chemical fume hood exhaust ductwork	Stainless Steel	6”	Neg	A	>2000	Welded
Chemical fume hood exhaust ductwork	FRP	6”	Neg	A	>2000	
Locker Room /Shower exhaust ductwork	Aluminum	2”		B	<2500	
Autoclave Exhaust	Aluminum	2”		B	<2500	

* For negative pressures over 3” w.g., refer to SMACNA Round and rectangular Industrial Duct Construction Standards for joint and intermediate reinforcement requirements.

8. Ducts required to be continuously welded and with all penetrations sealed (damper rods, access doors, etc.) shall be liquid-tight and shall be airtight. The leakage test shall yield a zero leak rate. All welding shall use inert gas shielding with filler rod equal to or exceeding the base metal properties.

9. Support
   a. Space hangers as required by SMACNA (8 ft max) for horizontal duct on 8 ft. centers, unless concentrated loadings require closer spacing.
   b. Support vertical duct on each floor or slab it penetrates.
   c. Supports for ductwork and equipment shall be galvanized unless specified otherwise.

10. Connections

    a. Connect inlets and outlets of heat recovery units and fans to ductwork with flexible connections unless fan has vibration isolator mounts inside unit with flexible connections.
    b. Indoors, flexible connections shall be neoprene-coated fibrous glass fire retardant fabric, by Ventfabrics, or Durodyne. Outdoors, flexible connections shall be Dupont hypalon-coated fibrous glass fire-, weather-, and UV-resistant by Ventfabrics or Durodyne.
    c. Secure flexible connections tightly to air handlers with metal bands. Bands shall be same material as duct construction.
    d. Connections from trunk to branch ducts shall be as detailed on Drawings.

11. Construction

    a. No sharp metal edges shall extend into air streams.
    b. Install drive slips on air-leaving side of duct with sheet metal screws on 6" centers.
    c. Spin in collars shall NOT be used.

12. Joints

    a. Longitudinal lock seams shall be double-locked and flattened to make tight joints.
    b. Make transverse joints, field connections, collar attachments and flexible connections to ducts and equipment with sheet metal screws or bolts and nuts. Do not use rivets and staples.

13. Prefabricated Transverse Duct Joints

    a. Transverse joints in galvanized sheet metal ductwork may be made with galvanized gasketed frame and angle duct joint system by Ductmate, TDF, TDC, or approved equal. Angles shall be at least 20 gauge. Prefabricated transverse duct joints shall not be used for duct 16 GA. and heavier, nor for duct 23 GA. or lighter.
    b. Secure angles to duct with screws (using clutched arbor) or spot-welds spaced as recommended by manufacturer for duct pressure class.

14. Elbows and Bends

    a. Elbows and bends for rectangular ducts shall have centerline radius of 1.5 times duct width wherever possible. Elbows for grease exhaust shall be full radius. Turning vanes and mitered elbows are not allowed in grease ducts.

    b. Where centerline radius is less than 1.5 times duct width (on supply, return and exhaust ductwork), elbows shall be radius throat with radius heel and full length splitter vanes when required. When centerline radius (r) divided by the duct width (w) is less than 1.5, provide the following number of splitter vanes: r/w between 1.49 and 0.7 = 1; r/w between

0.69 and 0.6 = 2; r/w between 0.59 and 0.55 = 3. Minimum inside radius (not centerline) shall be 2". Install vanes in accordance with SMACNA.

c. For round ductwork provide stamped elbows, with centerline radii equal to 1-1/2 times duct diameter, or gored elbows as follows:

Elbow Angle	No. of Gores
0 –36	2
37 –72	3
73 –90	5

15. Access Panels/Doors

a. Provide proper pressure and leakage rated, gasketed, duct mounted access panels/doors. In insulated ducts, access doors shall be insulated double wall. Gauges of door materials, no. of hinges, no. and type of door locks shall be as required by the SMACNA Duct Construction Standards. Unhinged doors shall be chained to frame with a minimum length of 6" to prevent loss of door. Door metal shall be the same as the attached duct material. The minimum sizes are:

1) Fire dampers - 12" x 12", or larger.
2) Automatic control dampers - 6" x 6" minimum.
3) Manual volume dampers 2 sf and larger - 6" x 6" minimum.
4) At additional locations indicated on drawings, or specified elsewhere - 12" x 12" minimum.
5) Flow measuring stations - 12" x 12" or larger.
6) Provide, as an alternate, access door for all supply air ductwork upstream and downstream of each elbow and tee and at intervals of approximately 40 ft. to allow maximum reach of 20 ft. in straight horizontal runs for cleaning - 24" x 24" unless duct size is smaller in which case largest size possible shall be used (min. 6" x 6").

b. Access doors are not shown on the drawings, but shall be provided in accordance with the above.

16. Extractors shall have adjusting rod and locknut on outside of duct.

17. Connections to roof fans:

a. Shall be at least 22 ga. galvanized steel soldered watertight.
b. Solder side seams at least 12" up from bottom.
c. Provide suitable dielectric gaskets to join dissimilar materials.

18. Plenums and connections to louvers:

a. Shall be 18 ga. minimum cross-broken and properly reinforced with galvanized angle irons to SMACNA requirements.
b. Shall have bottom and corner seams soldered watertight at least 12" up from bottom.

c. Shall have neoprene gaskets or other non-corrosible material to make connections to louvers watertight.
d. Shall pitch connection back towards the louver. Provide half-coupling drain connection at bottom of plenum unless noted otherwise. Pipe drain to nearest floor drain.
e. Shall have unused portions of louvers blocked-off with sheet metal; sealed air- and water-tight; insulated with 2" thick 6-lb. density rigid or board insulation.

19. Flexible Ductwork

a. Flexible ductwork, connecting to uninsulated or unlined duct, shall be vinyl coated fiberglass cloth 0.0057" minimum thickness, 25 strands per inch minimum thread count with corrosion-resistant helical wire reinforcement. Flex duct shall be U.L. rated for 12" W.C. positive pressure, 2" W.C. negative pressure with a maximum velocity of 4000 FPM. Flexduct must be listed as a Class 1 Connector according to UL 181 and shall meet the requirements of NFPA 90A - maximum ASTM E-84 fire hazard rating shall be 25 flame spread, 50 fuel contributed and 50 smoke developed. Uninsulated flexible duct shall be equivalent to Flexmaster Type 4.
b. Flexible duct connected to insulated or lined duct shall be insulated with 1-1/2", 1/2 lb. density fiberglass insulation and flame retardant (UL Listed) vapor barrier, meeting ASTM E-84 rating.
c. Submittals shall include data on core, in addition to other data listed above required to ensure that submitted product meets the requirements of these specifications.
d. If flexduct other than the models listed above is submitted, a sample of the flex shall be submitted to the Architect. The Architect shall have sole discretion in determining whether the submitted flex is equivalent to that of the named above.
e. Flexible duct shall be airtight, triple lock mechanically spiral formed with spiral corrugation. Material shall be 3003 zero temper aluminum, .0065" minimum thickness.
f. Provide sealing compound and metal draw bands for installation. See further paragraphs in this specification, and details for other installation requirements.

C. Double Wall Ductwork

1. Duct and fitting shall be United Sheet Metal Co., Acousti-K27, type P or Semco consisting of:
a. External pressure-tight shell of zinc-coated steel.

b. Uniformly packed, 1" layer of fire resistant fibrous glass insulation with K-factor of 0.27 with mylar or foil liner meeting 25/50 flame spread/smoke developed rating.

c. Internal perforated protective metal liner of zinc-coated steel, with holes sized and spaced to give acoustic impedance of noise reduction characteristic of Acousti-K27 duct.

d. Pressure shell of round duct shall be United or approved equal spiral pipe and pressure shell of fittings shall be zinc-coated steel, as follows:

Item	Size	Gauge of Pressure Shell
Duct	3" to 6"	26
	7" to 20"	24
	21" to 34"	22
	36" to 48"	20
Fitting	3" to 34"	20
	36" to 48"	18

e. Fittings shall be continuous, corrosion-resistant welds made by certified welders.

f. Joints between straight duct sections shall be made with pre-fabricated couplings with 4" shoulder inserted into duct.

D. Flexible Duct

1. Provide supports at manufacturer's recommended intervals. Sag shall not exceed ½" per foot of spacing between supports. Ducts shall not exceed 6 feet long and shall be used for straight run only, no offsets or turns.

2. Hanger and saddle in contact with flexible duct shall be wide enough to prevent restriction of internal duct diameter when weight of supported section rests on hanger or saddle material.

3. Factory installed suspension systems integral to flexible duct are acceptable as alternative hanging method when manufacturer's recommended procedures are followed.

4. Collars to which flexible ducts are attached shall be at least 2" long. Sleeves for joining sections of flexible duct shall be at least 4" long.

5. Apply sealing compound to metallic surface at connection of flexible duct with sheet metal ducts, collars and mixing boxes. Slip flexible ductwork over sealing compound. Complete seal with ½" wide, commercially made metal draw bands.

E. Combination Fire/Smoke Dampers

1. Combination Fire/Smoke Dampers shall be provided and installed where indicated on drawings and where required by code and local authorities. Refer to architects construction documents to identify fire rated walls and smoke barriers.

2. The combination fire/smoke damper (FSD) shall be equal to or better than a Ruskin model FSD60 with electronically controlled closure and a TS150 Firestat.

3. Sequence of Operation

a. Smoke condition operation - When smoke is detected (via a smoke detector), during testing or if power failure occurs, the damper will close and remain closed. When the smoke signal ceases (smoke detector

reset), the test is completed or power is restored, the damper will automatically reset to the open position. The damper automatically resets if nuisance alarms occur and the system is reset.

b. Fire condition operation – When temperatures in excess of 165°F / 74°C are detected, the damper will close and lock. At no time shall the damper be disengaged from the actuator. Upon cessation of the fire conditions, the damper can be reopened by pressing the reset button located on the damper assembly.

F. Fire Dampers

1. Fire Dampers shall be installed in the Ductwork where indicated on the drawings and required by the code and local authorities. See architect's construction documents to identify fire-rated walls and floors.

2. Fire Dampers shall be constructed and installed with visible fusible links in accordance with the requirements of the National Board of Fire Underwriters and the Underwriters'.

3. Inspection Authorities having jurisdiction in the locality. Fire Dampers shall be Buckley Model 150A or 150B (vertical or horizontal) as manufactured by Buckley Associates (781-878-5000) Sheet Metal Workers Local 17 or approved equal.

4. Dampers shall meet National Fire Protection Association requirements as outlined in the current N.F.P.A. bulletin 90-A. Dampers shall bear the Underwriters' label. Dampers shall be installed with metal sleeves and framing angles. All Dampers shall be installed in accordance with the means by which they were U.L. tested.

5. Free area must equal or exceed that of the specified product.

6. If additional wall or/and ceiling/floor framing for damper installation is required coordinate framing installation with GC.

7. HVAC contractor shall coordinate fire damper access panel locations with general contractor.

G. Volume Dampers

1. Note: Volume dampers are not shown on Drawings, but dampers shall be provided as necessary for system balancing and as required by this specification.

2. Provide manual adjustable volume dampers, with extended mount indicating and locking quadrants:

   a. On each supply, return and exhaust duct take-off.
   b. At each take-off to register, grille or diffuser (these are not shown on the drawings). Volume damper shall be as far away from diffuser or grille as possible for system balancing.

3. Dampers shall be ½" smaller in both dimensions or 1" smaller diameter than size of duct in which they are installed; e.g., use 23-½" by 23-½" damper for 24" square duct.

4. Dampers larger than 12" in height shall be opposed multi-blade.

5. Damper blades shall be two gauges heavier than adjoining ductwork, and shall be riveted to supporting rods. Hem over edges parallel to rods.

6. Brackets shall be galvanized metal, secured to ductwork with sheet metal screw with locking quadrant arms (see seal class section for additional requirements). Provide 2" handle extension for all dampers on externally insulated ductwork.

H. Gravity Backdraft Dampers

1. Backdraft dampers shall have 12 ga. galvanized steel channel frame with 14 ga. galvanized press formed steel sub frame and 16 ga. reinforced galvanized steel blades with edge seals. Dampers shall be designed for velocities up to 3,500 fpm.

2. Counter-balance arms shall be 2 x ¼ x 12" lg. hot rolled steel bar external to damper. Counter-weights shall be 2" dia. hot rolled steel bar attached to counter-balance arms. Axles shall be ½" dia. cadmium plated steel continuous rods with ½" dia. ball bearings. Dampers shall have plated steel center brackets; brass pivots; 5/16" plated steel linkage rod. Provide linkage on panels 31" to 48" wide. Damper shall have all welded construction.

3. Dampers shall be as manufactured by Vent Products (Model 3200) or equivalent by American Warming and Ventilating, Air Balance or Ruskin.

I. Motorized Dampers

1. Control dampers meeting the following specifications shall be furnished and installed where shown on plans and/or as described.

2. Dampers shall consist of: a 16-gauge galvanized steel channel frame with 5 in. depth; airfoil shaped, galvanized steel double skin construction blades (14-gauge equivalent thickness); blades shall be completely symmetrical relative to their axle pivot point, presenting identical resistance to airflow in either direction or pressure on either side of the damper; 1/2 in. diameter plated steel axles turning in synthetic (acetal) sleeve bearings; silicone blade seals; flexible stainless steel jamb seals; and external (out of the airstream) blade-to-blade linkage.

3. Damper manufacturer's printed application and performance data including pressure, velocity and temperature limitations shall be submitted for approval showing damper suitable for pressures to 8 in. water gage, velocities to 4000 fpm and temperatures to 250°F. Testing and ratings to be in accordance with AMCA Standard 500-D. Basis of design is Greenheck model VCD-33.

4. Damper air leakage shall not be greater than 3 cfm/sq. ft. @ 1 in. water gage.

5. Testing and ratings shall be per AMCA Standard 500-D.

J. Diffusers, Registers, and Grilles

1. Provide steel diffusers, registers and grilles for supply, return and exhaust outlets, of size, type and design shown on Drawings. Acceptable manufacturers shall be Titus, Metalaire, Nailor, or approved equal.

2. Equipment shall be tested and rated per ASHRAE 91-70.

3. Equipment shall handle air quantities at operating velocities:

   a. With maximum diffusion within space supplied or exhausted.
   b. Without objectionable air movement as determined by Architect.
   c. With sound pressure level not to exceed NC 30 or as specified on Drawings.

4. Supply, return and exhaust outlets shall have opposed blade volume dampers operable from front.

5. Supply registers shall have two sets of directional control blades.
6. Diffusers within same room or area shall be of same type and style to provide Architectural uniformity.

7. Surface mount diffusers, registers and grilles shall be furnished with gaskets and installed with faces set level and plumb, tightly against mounting surface.

8. Finish shall be as directed by Architect.

9. Coordinate diffusers, registers and grilles with ceiling and wall construction. Refer to Architectural Drawings for exact lengths and for framing and mitering arrangements that may differ from those shown on HVAC Drawings.

K. Ceiling diffusers for mounting in fire-rated floor ceiling assemblies

1. The products shall be classified by Underwriters' Laboratories for use in fire-rated floor/ceiling and or roof/ceiling assemblies with up to a 3 hour rating.

2. The discharge pattern shall be 4-way horizontal and shall be adjusted by dropping the perforated face and rotating the pattern deflectors. Removable face shall have spring clips for easy access to the damper.

3. The perforated face shall have 3/16" (5) diameter holes on 1/4" (6) staggered centers.

4. The finish shall be AW Appliance white.

5. Each diffuser shall be provided with a volume damper accessible for diffuser face for air volume adjustment.

L. Airflow and Temperature Measurement Devices

1. References

a. UL 873 – Temperature and Airflow Indicating Equipment

2. Submittals

a. Submit product data sheets for airflow measuring devices indicating minimum placement requirements, sensor density, sensor distribution, and installed accuracy to the host control system.

1) Devices whose accuracy is the combined accuracy of the transmitter and sensor probes must demonstrate that the total accuracy meets the performance requirements of this specification throughout the measurement range.

b. Submit a schedule of airflow measuring devices indicating compliance with specified accuracy at minimum and maximum airflow rates.

c. Submit installation, operation and maintenance documentation.

3. Qualifications

a. Manufacturer: The company manufacturing the products specified in this section shall have a minimum of ten years experience producing products of this type.

4. System Responsibility

a. The contractor shall be responsible for any and all costs associated with any and all changes resulting from the use of a supplier other than the listed acceptable manufacturer.

5. Warranty

a. Provide a manufacturer’s parts warranty for 36 months from the date of unit shipment.

6. Delivery, Storage, and Handling

a. All handling and storage procedures shall be per manufacturer’s recommendations
b. Airflow measuring devices shall be kept clean and dry, protected from weather and construction traffic.

7. Products Included in this Section

a. Duct and plenum mounted airflow measurement devices.
b. Fan inlet mounted airflow measurement devices.

8. Acceptable Manufacturers

a. EBTRON, Inc. Model GTx116-P and GTx116-F (basis of design).

1) Alternatives requesting acceptance as “equals” less than 60 days prior to bid date or products submitted in non-conformance

with the requirements of this specification will not be considered.

2) For any product to be considered for substitution a written section-by-section detailed exceptions/compliance document shall be submitted to the Engineer before any approval will be considered.

b. Provide airflow/temperature measurement devices (ATMD) where indicated on the plans. Fan inlet measurement devices shall not be substituted for duct or plenum measurement devices indicated on the plans.

c. Each ATMD shall consist of one or more sensor probes and a single, remotely mounted, microprocessor-based transmitter capable of independently processing up to 16 independently wired sensor assemblies. Each sensor assembly shall contain two individually wired, hermetically sealed bead-in-glass thermistors. Thermistors shall be mounted in the sensor assembly using a marine-grade, waterproof epoxy. Thermistor leads shall be protected and not exposed to the environment. The airflow rate of each sensor assembly shall be equally weighted and averaged by the transmitter prior to output. The temperature of each sensor assembly shall be velocity weighted and averaged by the transmitter prior to output. Each transmitter shall have a 16-character alpha-numeric display capable of displaying airflow, temperature, system status, configuration settings and diagnostics. Devices using chip-in-glass or diode-case chip thermistors are not acceptable. Devices using less than two thermistors in each sensor assembly are not acceptable. Devices using platinum wire RTDs are not acceptable. Devices having electronic circuitry mounted in or at the sensor probe are not acceptable. Pitot tubes and arrays are not acceptable. Vortex shedding devices are not acceptable.

d. All Sensor Probes

1) Each sensor assembly shall independently determine the airflow rate and temperature at each measurement point.

2) Each sensor assembly shall be calibrated at a minimum of 16 airflow rates and 3 temperatures to standards that are traceable to the National Institute of Standards and Technology (NIST).

3) Airflow accuracy shall be +/-2% of reading over the entire operating airflow range.

a) Devices whose accuracy is the combined accuracy of the transmitter and sensor probes must demonstrate that the total accuracy meets the performance requirements of this specification throughout the measurement range.

4) Temperature accuracy shall be +/-0.15° F over the entire operating temperature range of -20° F to 160° F.

5) The operating humidity range for each sensor probe shall be 0-99% RH (non-condensing).

6) Each sensor probe shall have an integral, U.L. listed, plenum rated cable and terminal plug for connection to the remotely mounted transmitter. All terminal plug interconnecting pins shall be gold plated.

7) Each sensor assembly shall not require matching to the transmitter in the field.

8) A single manufacturer shall provide both the airflow/temperature measuring probe(s) and transmitter for each measurement location.

e. Duct and Plenum Probes

1) Probes shall be constructed of extruded, gold anodized, 6063 aluminum tube. All wires within the aluminum tube shall be Kynar coated.

2) Probe assembly mounting brackets shall be constructed of 304 stainless steel. Probe assemblies shall be mounted using one of the following options:
   a) Insertion mounted through the side or top of the duct
   b) Internally mounted inside the duct or plenum
   c) Standoff mounted inside the plenum

3) The number of sensor housings provided for each location shall be as follows:

Area (sq. ft.)	Sensors
<2	4
2 to <4	6
4 to <8	8
8 to <16	12
>=16	16

4) The operating airflow range shall be 0 to 5,000 FPM unless otherwise indicated on the plans.

f. Fan Inlet Probes

1) Sensor assemblies shall be mounted on 304 stainless steel housings.

2) Mounting rods shall be field adjustable to fit the fan inlet and constructed of nickel plated steel.

3) Mounting feet shall be constructed of 304 stainless steel.

4) The operating airflow range shall be 0 to 10,000 FPM unless otherwise indicated on the plans.

g. Transmitters

1) The transmitter shall have an integral LCD display capable of simultaneously displaying airflow and temperature. The LCD display shall be capable of displaying individual airflow and temperature readings of each independent sensor assembly.

2) The transmitter shall be capable of field configuration and diagnostics using an on-board pushbutton interface and LCD display.

3) The transmitter shall have a power switch and operate on 24 VAC (isolation not required). The transmitter shall use a switching power supply fused and protected from transients and power surges. The transmitter shall use “watch-dog” circuitry to assure reset after power disruption, transients and brown-outs.

4) All interconnecting pins, headers and connections on the main circuit board, option cards and cable receptacles shall be gold plated.

5) The operating temperature range for the transmitter shall be -20° F to 120° F. The transmitter shall be installed at a location that is protected from weather and water.

6) The transmitter shall be capable of communicating with other devices using one of the following interface options:

a) Linear analog output signals for airflow and temperature: Field selectable, fuse protected and isolated, 0-10VDC/4-20mA (4-wire).

b) RS-485: Field selectable BACnet-ARCNET, BACnet-MS/TP, ModBus-RTU or Johnson Controls N2-Bus.

(1) BACnet devices shall provide analog variables for airflow and temperature containing individual sensor airflow rate and temperature data.

c) 10 Base-T Ethernet: Field selectable BACnet Ethernet, BACnet-IP, ModBus-TCP and TCP/IP.

(1) Provide dynamic link libraries and VBA functions to interface Ethernet devices to Microsoft Excel for remote monitoring of airflow and temperature using a Windows 2000 or Windows XP based PC.

d) LonWorks Free Topology

7) The transmitter shall be capable of accepting an infra-red interface card for downloading airflow and temperature data or uploading transmitter configuration data using a handheld PDA (Palm or Microsoft Windows Mobile operating systems).

a) Provide PDA upload/download software. Download software shall be capable of displaying and saving individual sensor airflow rates, the average airflow rate, individual sensor temperatures and the average temperature received from the transmitter. Upload software shall be capable of displaying and saving all setup parameters that can be configured using the on-board pushbutton interface and LCD display.

b) Provide a Microsoft Excel file capable of creating balance reports from PDA data files transferred to a Windows 98 or higher based PC.

c) Provide a Microsoft Excel file to create configuration data files that can be transferred from a Windows 98 or higher based PC to a PDA for upload to one or more transmitters.

h. The measuring device shall be UL listed as an entire assembly.

i. The measuring device shall carry the CE mark for European Union shipments.

j. The manufacturer's authorized representative shall review and approve placement and operating airflow rates for each measurement location indicated on the plans. A written report shall be submitted to the consulting mechanical engineer if any measurement locations do not meet the manufacturer's placement requirements.

9. Installation

a. Install in accordance with manufacturer's instructions at the locations indicated on the plans. A written report shall be submitted to the consulting mechanical engineer if any discrepancies are found.

10. Adjusting

a. Duct and plenum devices shall not be adjusted approval from the consulting mechanical engineer.

2.10 INSULATION FOR SHEET METAL

A. Note that ductwork, which is acoustically lined, still needs exterior insulation to meet the total "R" value requirements as stated below. Insulation thickness must also meet the requirements of current State and Local codes, if greater than shown below.

B. Insulate sheet metal as follows:

1. All supply & return ductwork to diffusers, grilles, and registers: Type D-1.

2. Sheet metal plenums behind louvers: Type D-2.

3. Outdoor ducts: Type D-2 and weather proofed.

4. Exhaust air duct from automatic dampers to discharge louvers (including sheet metal plenums behind louvers): Type D-2.

C. Type D-1 Flexible Duct Insulation With Vapor Barrier

1. Flexible duct insulation shall be R-8 (total R value) glass fiber with a maximum k factor of 0.29 at 75 degrees F mean temperature, with reinforced foil-faced, flame resistant Kraft vapor barrier. (Reduce thickness if lined).

2. Insulation shall be secured with duct adhesive. All joints shall be sealed by adhering a 2” sealing lap at all joints with vapor barrier adhesive or 3” strips of vapor barrier jacket applied with vapor barrier adhesive. Insulation shall then be fastened with 16 gauge copper-clad wire or fiberglass cord on 12” centers. On ducts over 24” wide, welded pins and clips shall be used on the underside.

3. Exposed round shall have a white vinyl reinforced foil vapor barrier. Application same except wires shall be omitted and blanket shall be secured by stapling 2” longitudinal lap. Staples shall be coated with vapor barrier coating.

D. Type D-2 Rigid Duct Insulation With Vapor Barrier

1. Rigid duct insulation shall be R-12 (total R value) glass board with maximum k factor of .24 at 75 degrees F mean temperature with vapor barrier facing. (Reduce thickness if lined).

2. Insulation shall be impaled over welded pins applied to duct surface on 12” to 18” centers. Use a minimum of two rows of fasteners on each side of duct. Secure insulation with suitable speed washers or clips firmly embedded into insulation.

3. All joints and voids in the insulation shall be filled with Mineral Wool Cement. All joints, speed washers and breaks in the vapor barrier shall be sealed with 3” wide strips of the vapor barrier facing adhered with vapor barrier adhesive.

4. Exposed ductwork shall have a white reinforced foil vapor barrier facing. Care shall be taken in sealing joints, speed washers, etc. with matching strips of vapor barrier to insure good appearance.

2.11 FLEXIBLE CONNECTIONS

A. All fan and air supply unit connections, both at inlet and discharge shall be made with flexible material so as to prohibit the transfer of vibration from fans to ductwork connecting thereto, without air leakage. The material between the clamps shall have sufficient slack so as to prevent tearing due to fan movement.

B. The flexible connections shall be a maximum of 12” long and held in place with heavy metal bands, securely attached, to prevent any leakage at the connection points.

C. Flexible connections shall be fabricated from approved flame proved fabric conforming to 90A of the NFPA Asbestos cloth is not permitted.

2.12 ESCUTCHEONS AND DUCT COLLARS

A. Provide adjustable escutcheons on exposed piping that passes through finished floors, walls and ceilings. Escutcheons shall be chromium-plated cast brass, sized to cover sleeve opening and to accommodate pipe and insulation.

B. Provide 4” wide 20 gauge galvanized sheet metal collars at sleeves and prepared openings, sized to cover entire duct penetration including sleeve and seal, and to accommodate duct and insulation as necessary. Edges shall have milled lips ground smooth. Paint to match finish of duct or as directed by Architect.

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PART 3 - EXECUTION

3.01 DEMOLITION

A. General

1. The Contractor shall completely familiarize himself with all existing building and site conditions and limitations which may have a bearing on the operations herein specified, and shall include all work required to complete the project as shown on the drawings and be required by the specifications. No extra compensation will be allowed for unforeseen conditions that can be determined from a careful examination of the site, building, drawings and specifications.

2. Items of value which are not indicated to be returned to the Owner shall become the property of the Contractor. Storage or sale of the items on the project site is prohibited.

3. Protection: Ensure the safe passage of persons in and around the building during demolition. Prevent injury to persons and damage to property. Provide adequate shoring and bracing to prevent collapse. Immediately repair damaged property to the condition before being damaged. Take effective measures to prevent windblown dust.

4. Utilities: Maintain all utilities except those requiring removal or relocation. Keep utilities in service and protect from damage. Do not interrupt utilities serving used areas without first obtaining permission from the utility company and the Owner. Provide temporary services as required.

B. Regulators Requirements

Strictly comply with applicable codes, regulations and requirements of authority having jurisdiction.

C. Handling of Materials

Remove salvage and debris from the site as it accumulates. Do not store, sell, burn, or otherwise dispose of debris on site. Remove all materials in such manner as to prevent spillage. Keep all pavements and areas adjacent to and leading from the site, clean and free of mud, dirt, and debris at all times.

D. Inspections

Prior to commencement of selective demolition work, inspect areas in which work will be performed. Photograph existing conditions to structure surfaces, equipment or to surrounding properties which could be misconstructed as damage resulting from selective demolition work; file with Owner’s Representative prior to starting work.

E. Transfer of Responsibility and Disposition of Materials

Upon receipt of notice to proceed with the work, the tile to all materials for demolition shall be vested in the Contractor whereupon the Owner will not be responsible for the condition, loss, or damage to said property.

F. Disposal of Demolished Materials

Remove unused fixture and all piping servicing fixture including abandoned piping not associated with said fixture. Remove piping back to the next live branch will not obstruct the new work. Transport and legally dispose of materials off site.

G. Clean-up and Repair

1. Upon completion of demolition work, remove tools, equipment and demolished materials from site. Remove protections and leave interior areas broom clean.

2. Repair demolition performed in excess of that required. Return structures and surfaces to remain in condition existing prior to commencement of selective demolition work. Repair adjacent construction or surfaces soiled or damaged by selective demolition work.

3.02 INSTALLATION OF PIPING INSULATION

A. Install insulation products in accordance with manufacturer's written instructions, and in accordance with recognized industry practices to ensure that insulation service its intended purpose.

B. Install insulation on pipe systems subsequent to installation of heat tracing, painting, testing, and acceptance of tests.

C. Install insulation materials with smooth and even surfaces. Insulate each continuous run of piping with full-length units of insulation, with single cut piece to complete run. Do not use cut pieces or scraps abutting each other.

D. Clean and dry pipe surfaces prior to insulating. Butt insulation joints firmly together to ensure complete and tight fit over surfaces to be covered.

E. Maintain integrity of vapor-barrier jackets on pipe insulation, and protect to prevent puncture or other damage.

F. Cover valves, fittings and similar items in each piping system with equivalent thickness and composition of insulation as applied to adjoining pipe run. Install factory molded, precut or job fabricated units (at Installer's option) except where specific form or type is indicated.

G. Extend piping insulation without interruption through walls, floors and similar piping penetrations, except where otherwise indicated.

H. Butt pipe insulation against pipe hanger insulation inserts. For hot pipes, apply 3 inch wide vapor barrier tape or band over the butt joints. For cold piping apply wet coat of vapor barrier lap cement on butt joints and seal joints with 3 inch wide vapor barrier tape or band.

3.03 INSTALLATION OF DUCTWORK INSULATION

A. Install insulation products in accordance with manufacturer's written instructions, and in accordance with recognized industry practices to ensure that insulation serves its intended purpose.

B. Install insulation materials with smooth and even surfaces.

C. Clean and dry ductwork prior to insulating. Butt insulation joints firmly together to ensure complete and tight fit over surfaces to be covered.

D. Maintain integrity of vapor-barrier on ductwork insulation, and protect it to prevent puncture and other damage.

E. Extend ductwork insulation without interruption through walls, floors and similar ductwork penetrations, except where otherwise indicated.

F. Lined Ductwork

1. Except as otherwise indicated, omit insulation on ductwork where internal insulation or sound absorbing linings have been installed.

G. Ductwork Exposed to Weather

1. Protect outdoor insulation from weather by installing outdoor protective finish or jacketing as recommended by manufacturer.

H. Corner Angles

1. Except for oven and hood exhaust duct insulation, install corner angles on external corners of insulation on ductwork to exposed finished spaces before covering with jacketing.

3.04 INSTALLATION OF EQUIPMENT INSULATION

A. Install equipment thermal insulation products in accordance with manufacturer's written instructions, and in compliance with recognized industry practices to ensure that insulation serves intended purpose.

B. Install insulation materials with smooth and even surfaces and on clean and dry surfaces. Redo poorly fitted joints. Do not use mastic or joint sealer as filler for gapping joints and excessive voids resulting from poor workmanship.

C. Maintain integrity of vapor-barrier on equipment insulation and protect it to prevent puncture and other damage.

D. Do not apply insulation to equipment, breechings, or stacks while hot.

E. Apply insulation using staggered joint method for both single and double layer construction, where feasible. Apply each layer of insulation separately.

F. Coat insulated surfaces with layer of insulating cement, trowelled in workmanlike, manner, leaving smooth continuous surface. Fill in scored block, seams, chipped edges and depressions, and cover over wire netting and joints with cement of sufficient thickness to remove surface irregularities.

G. Cover insulated surfaces with all service jacketing neatly fitted and firmly secured. Lap seams at least 2 inches. Apply over vapor barrier where applicable.

H. Do not insulate boiler manholes, handholes, cleanouts, ASME stamp, and manufacturer's nameplate. Provide neatly beveled edge at interruptions of insulation.

I. Provide removable insulation sections to cover parts of equipment which must be opened periodically for maintenance; include metal vessel covers, fasteners, flanges, frames and accessories.

J. Equipment Exposed to Weather

1. Protect outdoor insulation from weather by installation of weather-barrier mastic protective finish, or jacketing, as recommended by manufacturer.

3.05 SYSTEM TESTING, ADJUSTING, AND BALANCING

A. Summary

1. Testing, adjusting and balancing (TAB) of the air conditioning systems and related ancillary equipment will be performed by an impartial technically qualified TAB firm.

2. The firm shall be capable of performing the services specified at the location of the facility described within the time specified, of preparing and submitting the detailed report of the actual field work performed, and following up the basic work as may be required.

B. Qualifications

1. The Firm shall be one which is organized to provide professional services of this specified type in the State of Massachusetts.

2. The Firm shall have operated a minimum of five (5) years under its current Firm name, and shall be in good standing with the State of MA. The firm shall submit their full incorporated name, Charter Number and Taxpayer's I.D. Number for proper verification of the firm's status.

3. The Firm shall be capable of providing a performance bond, by a bonding company licensed to do business in the State of MA, if determined by the Owner that such a bond is required. The amount of the bond which may be required shall be equal to the cost of the proposal submitted, or in the case of more than one proposal, the sum of all such proposals and any awarded work in progress.

4. All personnel used on the job site shall be either professional engineers or engineering technicians, who shall have been permanent, full time employees of

the firm for a minimum of six (6) months prior to the start of work for this specific project.

5. The TAB firm shall submit biographical data on the individual proposed to directly supervise the TAB work, as well as other personnel scheduled to perform the technical work under the contract. It shall also submit a background record of at least five years of specialized experience in the field of air and hydronic system balancing, and shall possess properly calibrated instrumentation. The supervisory personnel for the TAB firm shall be registered engineers in the mechanical field and all of the employees used in the TAB firm shall be permanent, full-time employees of the firm.

C. References

1. AABC - National Standards for Testing and Balancing Heating, Ventilating, and Air Conditioning Systems, Sixth Edition 2002.

2. ASHRAE - 2011 HVAC Applications Chapter 38: Testing, Adjusting and Balancing.

3. ANSI/ASHRAE Standard 111 – 2008 - Practices for Measurement, Testing, Adjusting and Balancing of Buildings, Heating, Ventilation, Air Conditioning and Refrigeration Systems.

D. Documents

1. The TAB firm shall, as a requirement of the TAB contract, arrange with the Architect / Owner / Engineer to compile one set of mechanical, specifications, all pertinent change orders, and the following:

   a. One complete set of Drawings less the structural sheets.
   b. One set of mechanical floor plans of the conditioned spaces. These Drawings shall be ozalid type (blue or black on light background) reproductions to facilitate marking.

2. Approved submittal data on equipment installed, and related changes as required to accomplish the test procedures outlined in Paragraphs 1.06 through 1.10 of this Specification will be available through the Construction Supervisor.

E. Responsibilities of the Tab Firm

1. The TAB personnel shall check, adjust, and balance the components of the air conditioning system which will result in optimal noise, temperature, and airflow conditions in the conditioned spaces of the building while the equipment of the system is operating economically. This is intended to be accomplished after the system components are installed and operating as provided for in the contract documents. It is the responsibility of the Mechanical Contractor to place the equipment into service. Variable air volume systems shall be balanced in accordance with AABC 1989 Standard, Fifth Edition.

2. Liaison and Early Inspection

a. The TAB firm personnel on the job shall act as liaison between the Owner, Architect and Contractor. The following reviews (observations) and tests shall be performed by the TAB Agency:

1) During the design stage, before the documents are finalized, review the mechanical drawings and specifications for balanceability and provide commentary.
2) During construction, review all HVAC submittals such as control diagrams, air handling devices, etc., that pertain to commissioning work and balanceability.
3) Allow for a fixed number of trips to the project site, over and above those required for testing and balancing for inspection of installation of the mechanical piping systems, sheet metal work, temperature controls and other component parts of the heating, air conditioning and ventilating systems during the construction stage. These inspections shall be made prior to and/or at the above ceiling inspection. Commentary will be provided for each observation.
4) Test one (1) of each specified type of terminal box for performance capability and leakage. The shipment of the box to the TAB Agency's lab will be at the manufacturer's cost and the test period will be for three (3) weeks from receipt of the box. Submittal data will not be approved until box testing passes. If the sample box is rejected for any reason the second test will be at the Contractor's cost and the time allowed will restart when the box is received at the TAB Agency.
5) Test 10% of each specified terminal boxes type for casing and damper leakage when the shipment arrives at the project site. All testing (except for the initial boxes) shall be performed on site. Boxes requiring re-testing will be charged to the Contractor at the unit price provided to the Owner.
6) Test one (1) lab configuration including fume hood with air valve, general exhaust air with air valve and supply air with air valve for performance capability through a full range of inlet pressures. The tracking capability of the exhaust air versus the supply air will be with the submitted hood sash fully open and as the sash is closed in 2" increments until fully closed. Track the three (3) valve's response time in relation to sash movement and the lab differential.

b. During the balancing process, as abnormalities and malfunctions of equipment or components are discovered by the TAB personnel, the Construction Supervisor shall be advised in writing so that the condition can be corrected by the Mechanical Contractor. The written document need not be formal, but must be understandable and legible. Data from malfunctioning equipment shall not be recorded in the final TAB report. The TAB firm shall not instruct or direct the Contractor in any of the work, but will make such reports as are necessary to the Owner.

F. Final Air Balance

1. General: When systems are complete and ready for operation, the TAB Consultant will perform a final air balance for all air systems and record the results. The outside, supply, exhaust and return air volume for each air handling unit, supply fan and exhaust fan and the supply, exhaust or return air volume for each distribution device shall be adjusted to within +5% of the value shown on the drawings. Air handling unit and fan volumes shall be adjusted by changing fan speed and adjusting volume dampers associated with the unit. Air distribution device volume shall be adjusted using the spin-in tap damper for flexible duct connected devices and the device OBD for duct connected devices. Air distribution devices shall be balanced with air patterns as specified. Duct volume dampers shall be adjusted to provide air volume to branch ducts where such dampers are shown. The general scope of balancing by the TAB Consultant will include, but is not limited to, the following:

   a. Filters: Check air filters and filter media and balance only system with essentially clean filters and filter media. The Contractor shall install new filters and filter media prior to the final air balance.

   b. Blower Speed: Measure RPM at each fan or blower to design requirements. Where a speed adjustment is required, the Contractor shall make any required changes.

   c. Ampere Readings: Measure and record full load amperes for motors.

   d. Static Pressure: Static pressure gains or losses shall be measured across each supply fan, cooling coil, heating coil, return air fan, air handling unit filter and exhaust fan. These readings shall be measured and recorded for this report at the furthest air device or terminal unit from the air handler supplying that device. Static pressure readings shall also be provided for systems which do not perform as designed.

   e. Equipment Air Flow: Adjust and record exhaust, return, outside and supply air CFM (s) and temperatures, as applicable, at each fan, blower and coil.

   f. Coil Temperatures: Set controls for full cooling and for full heating loads. Read and record entering and leaving dry bulb and wet bulb temperatures (cooling only) at each cooling coil, heating coil and HVAC terminal unit. At the time of reading record water flow and entering and leaving water temperatures (In variable flow systems adjust the water flow to design for all the above readings).

   g. Zone Air Flow: Adjust each zone of multi-zone units, each HVAC terminal unit and air handling unit for design CFM.

   h. Outlet Air Flow: Adjust each exhaust inlet and supply diffuser, register and grille to within +5% of design air CFM. Include all terminal points of air supply and all points of exhaust. Note: For Labs and Rooms that are negative exhaust air flow shall be set to design +10% and supply to design -5%. Positive areas will have opposite tolerances.

i. Pitot Tube Traverses: For use in future troubleshooting by maintenance personnel, all exhaust ducts, main supply ducts and return ducts shall have air velocity and volume measured and recorded by the traverse method. Locations of these traverse test stations shall be described on the sheet containing the data.

j. Maximum and minimum air flow on terminal boxes.

G. Final Chilled and Heating Hot Water Balance

1. General: When systems are completed and ready for operation, the TAB Consultant will perform a final water balance for each chilled and hot water system. The general scope of balancing by the TAB Consultant will include, but not be limited to, the following:

a. Adjusted System Tests: Adjust balancing valves at each coil and heat exchanger for design flow, +5%. Adjust balancing valves at pumps to obtain design water flow. Record pressure rise across pumps and GPM flow from pump curve. Permanently mark the balanced position for each valve (Note: If discharge valves on the pumps are used for balancing record the head being restricted by the valves).

b. Temperature Readings: Read and record entering and leaving water temperature at each water coil, converter and heat exchanger. Adjust as necessary to secure design and conditions. Provide final readings at all thermometer well locations.

c. Pressure Readings: Water pressure shall be recorded at all gauge connections. Pressure readings at coils and pumps shall be related to coil and pump curves in terms of GPM flow through flow measuring status, if provided and installed, at each air handler. The flow of water through all water coils shall be adjusted by manipulating valves until the rated pressure drops across each coil is obtained and total water flow is verified by flow measuring status. For coils equipped with 3-way valves, the rated pressure drop shall first be adjusted through the coils. The bypass valve shall then be adjusted on each coil until an equal pressure drop between supply and return connections is the same as with the flow through the coil.

d. Ampere Readings: Reading and record full load amperes for each pump motor.

H. Sound Vibration and Alignment

1. Sound: Read and record sound levels at up to 15 locations in the building designated by the Engineer. All measurements shall be made using an Octave Band Analyzer. All tests shall be conducted when the building is quiet in the presence of the Engineer, if he so desires.

2. Vibration: Read and record vibration for all water circulating pumps, air handling units, and fans which have motors larger than 10 HP. Include equipment vibration, bearing housing vibration, foundation vibration, building structure

vibration, and other tests as directed by the Engineer. Readings will be made using portable IRD (or approved equal) equipment capable of filtering out various unwanted frequencies and standard reporting forms. Maximum vibration at any point listed above, or specified, shall not exceed 1 mil on fans and 1 mil on pumps unless otherwise specified. Equipment manufacturers shall rectify all systems exceeding vibration tolerances.

I. Testing of Temperature Control Systems

1. In the process of performing the TAB work, the TAB Agency shall:

a. Work with the temperature control contractor to ensure the most effective total system operation within the design limitations, and to obtain mutual understanding of intended control performance.
b. Verify that all control devices are properly connected.
c. Verify that all dampers, valves and other controlled devices are operated by the intended controller.
d. Verify that all dampers and valves are in the position indicated by the controller (open, closed or modulating).
e. Verify the integrity of valves and dampers in terms of tightness of close-off and full-open positions. This includes dampers in multi-zone units, terminal boxes and fire/smoke dampers.
f. Observe that all valves are properly installed in the piping system in relation to direction of flow and location.
g. Observe the calibration of all controllers.
h. Verify the proper application of all normally opened and normally closed valves.
i. Observe the locations of all thermostats and humidistats for potential erratic operation from outside influences such as sunlight, drafts or cold walls.
j. Observe the locations of all sensors to determine whether their position will allow them to sense only the intended temperatures or pressures of the media. Control Contractor will relocate as deemed necessary by the TAB Agency.
k. Verify that the sequence of operation for any control mode is in accordance with approved shop drawings and specifications. Verify that no simultaneous heating and cooling occurs.
l. Verify that all controller setpoints meet the design intent.
m. Check all dampers for free travel.
n. Verify the operation of all interlock systems.
o. Perform variable volume system verification to assure the system and its components track with changes from full flow to minimum flow.

2. A systematic listing of the above testing and verification shall be included in the final TAB report.

J. Stairwell Pressurization Systems

1. With all doors closed, measure the door pull to determine that the opening force required is below 30 #/ft.

2. With all doors closed, measure the pressure differential across each door to verify the pressure differentials at each floor.

3. Measure the air flow in the stairwell with the maximum number of doors fully open by pitot tube traverse, if traverse locations are available. If traverse locations are not available, measure air flow at each outlet.

4. Verify with smoke that the smoke detector in the stair pressurization fan inlet shuts the fan down.

K. Reports

1. The activities described in this section shall culminate in a report to be provided in quadruplicate (4) individually bound. Neatly type and arrange data. Include with the data the date tested, personnel present, weather conditions, nameplate record of test instrument and list all measurements taken after all corrections are made to the system. Record all failures and corrective action taken to remedy incorrect situation. The intent of the final report is to provide a reference of actual operating conditions for the Owner's operations personnel.

2. All measurements and recorded readings (of air, water, electricity, etc.) that appear in the reports must have been made onsite by the permanently employed technicians or engineers of the firm.

3. At the option of the Construction Supervisor, all data sheets tabulated each day by TAB personnel shall be submitted for initial by the Construction Inspector. Those work sheets so initialed, or copies thereof, shall be presented as a supplement to the final TAB report.

4. Submit reports on forms approved by the Owner & Engineer which will include the following information as a minimum:

   a. Title Page

      1) Company Name
      2) Company Address
      3) Company telephone number
      4) Project name
      5) Project location
      6) Project Manager
      7) Project Engineer
      8) Project Contractor
      9) Project Identification Number

   b. Instrument List

      1) Instrument
      2) Manufacturer
      3) Model
      4) Serial Number
      5) Range
      6) Calibration date

7) What test instrument was used for

c. Fan Data (Supply and Exhaust)

1) Location
2) Manufacturer
3) Model
4) Air flow, specified and actual
5) Total static pressure (total external), specified and actual
6) Inlet pressure
7) Discharge pressure
8) Fan RPM

d. Return Air/Outside Air Data (If fans are used, same data as for 3 above)

1) Identification/location
2) Design return air flow
3) Actual return air flow
4) Design outside air flow
5) Return air temperature
6) Outside air temperature
7) Required mixed air temperature
8) Actual mixed air temperature

e. Electric Motors

1) Manufacturer
2) HP/BHP
3) Phase, voltage, amperage, nameplate, actual
4) RPM
5) Service factor
6) Starter size, heater elements, rating

f. V-Belt Drive

1) Identification/location
2) Required driven RPM
3) Driven sheave, diameter and RPM
4) Belt, size and quantity
5) Motor sheave, diameter and RPM
6) Center-to-center distance, maximum, minimum and actual

g. Duct Traverse

1) System zone/branch
2) Duct size
3) Area
4) Design velocity
5) Design air flow
6) Test velocity
7) Test air flow
8) Duct static pressure

9) Air temperature
10) Air correction factor

h. Air Monitoring Station Data

1) Identification/location
2) System
3) Size
4) Area
5) Design velocity
6) Design air flow
7) Test velocity
8) Test air flow

i. Air Distribution Test Sheet

1) Air terminal number
2) Room number/location
3) Terminal type
4) Terminal size
5) Area factor
6) Design velocity
7) Design air flow
8) Test (final) velocity
9) Test (final) air flow

j. Pump Data

1) Identification/number
2) Manufacturer
3) Size/model
4) Impeller
5) Service
6) Design flow rate, pressure drop, BHP
7) Actual flow rate, pressure drop, BHP
8) Discharge pressure
9) Suction pressure
10) Total operating head pressure
11) Shut off, discharge and suction pressure
12) Shut off, total head pressure
13) Pressure differential settings

k. Cooling Coil Data

1) Identification/number
2) Location
3) Service
4) Manufacturer
5) Entering air DB temperature, design and actual
6) Entering air WB temperature, design and actual
7) Leaving air DB temperature, design and actual
8) Leaving air WB temperature, design and actual

9) Water pressure flow, design and actual
10) Water pressure drop, design and actual
11) Entering water temperature, design and actual
12) Leaving water temperature, design and actual
13) Air pressure drop, design and actual

l. Heating Coil Data

1) Identification/number
2) Location
3) Service
4) Manufacturer
5) Air flow, design and actual
6) Water flow, design and actual
7) Water pressure drop, design and actual
8) Entering water or steam temperature, design and actual
9) Leaving water temperature, design and actual
10) Entering air temperature, design and actual
11) Leaving air temperature, design and actual
12) Air pressure drop, design and actual

m. Sound Level Report

1) Location (Location established by the design engineer)
2) NC curve for eight (8) bands - equipment off
3) NC curve for eight (8) bands - equipment on

n. Vibration Test on equipment having 10 HP motors or above

1) Location of Points

a) Fan bearing, drive end
b) Fan bearing, opposite end
c) Motor bearing, center (if applicable)
d) Motor bearing, drive end
e) Motor bearing, opposite end
f) Casing (bottom or top)
g) Casing (side)
h) Duct after flexible connection (discharge)
i) Duct after flexible connection (suction)

2) Test Readings

a) Horizontal, velocity and displacement
b) Vertical, velocity and displacement
c) Axial, velocity and displacement

3) Normally acceptable readings, velocity and acceleration
4) Unusual conditions at time of test
5) Vibration source (if non-complying)

o. Control verification indicating date performed and any abnormalities identified.

1) Point Location/Description
2) EMS Readout (Setpoint and Actual)
3) Actual Readout
4) Interlocks
5) Safeties

a) VSD Normal Operation
b) VSD Bypass Operation

6) Alarms
7) Sequences of Operation

3.06 CLEANING AND PROTECTING

A. It shall be this trade's responsibility to store his materials in a manner that will maintain an orderly clean appearance. If stored on-site in open or unprotected areas, all equipment and material shall be kept off the ground by means of pallets or racks, and covered with tarpaulins.

END OF SECTION

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SECTION 260000

ELECTRICAL

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. All of the Contract Documents, including General and Supplementary conditions and Divisions 1 General requirements, apply to the work of this section.

B. Examine all Drawings and all other Sections of the Specifications for requirements affecting the work of this Section.

1.02 SCOPE

A. Provide all labor, materials, tools and equipment for the installation of the complete and fully operational electrical system as shown on the drawings and as specified herein.

B. The work includes, but is not limited to the following:

1. Interior secondary distribution systems including magnetic starters, overcurrent and switching devices, panelboards, raceways, cables, wiring, junction and pull boxes, wireways, and all other components required for complete electrical distribution system.
2. Feeders, branch circuit wiring and raceways.
3. Conduit, wire, boxes, fittings, hangers and supports.
4. Switches, receptacles, dimmers, special purpose outlets and wall plates.
5. Safety disconnects switches, non-fused and fused with fuses.
6. Lighting system including lamps, lenses, ballasts, devices, controls and exit signs.
7. Motor connections and controls.
8. Power connections to all plumbing, mechanical, kitchen equipment, and any other equipment that requires power.
9. Nameplates on all electrical equipment and components.
10. Seal penetrations between foundation floors and walls with fire retardant material.
11. Obtain all permits and associated fees.
12. Testing of all electrical systems.
13. Coordination between electrical and other trades.
14. All other systems hereinafter specified or indicated on the Contract Drawings, complete, leaving ready an electrical system in perfect operating condition.

1.03 DEFINITIONS

A. As used in this Section, “provide” means “furnish and install” and “POS” means “Provided Under Other Sections”.

B. As used in the drawings and specifications for electrical work, certain non-technical words shall be understood to have specific meanings as follows regardless of indications to the contrary in the general conditions or other documents governing the electrical work.

"Furnish" Purchase and deliver to the project site complete with every necessary appurtenance and support, all as part of this work. Purchasing shall include payment of all sales taxes and other surcharges as may be required to assure that purchased items are free of all liens, claims or encumbrances.

"Install" Unload at the delivery point at the site and perform every operation necessary to establish secure mounting and correct operation at the proper location in the project, all as part of this work.

"Provide" "Furnish" and "Install".

"New" Manufactured within the past two years and never before used.

C. Except where modified by a specific notation to the contrary, it shall be understood that the indication and/or description of any electrical item in the drawings or specifications for electrical work carries with it the instruction to furnish, install and connect the item as part of the electrical work, regardless of whether or not this instruction is explicitly stated.

D. It shall be understood that the specifications and drawings for electrical work are complimentary and are to be taken together for a complete interpretation of the electrical work except that indications on the drawings, which refer to an individual element of work, take precedence over the specifications where they conflict with same.

1.04 WORK BY OTHERS

A. The following is related work specified elsewhere:

1. HVAC Equipment including providing individual motor starters, adjustable frequency drives, control wiring, variable speed switches and devices shall be provided by HVAC contractor.

2. Temperature control wiring by HVAC contractor.

3. Access panels, where required, are furnished by the General Contractor and coordinated with this section.

1.05 CODES, PERMITS, AND STANDARDS

A. Provide all permits and licenses. Obtain and pay all certificates of inspection as required by regulatory agencies and submit for approval.

B. All materials and equipment shall be new and designed, constructed, installed and tested in accordance with the specification and the following standards:

1. National Electrical Code (NEC)
2. Occupational Safety and Health Act (OSHA)
3. National Fire Protection Association (NFPA)
4. Underwriters Laboratory (UL)
5. American National Standards Institute (ANSI)
6. National Electrical Manufacturers Association (NEMA)
7. Americans with Disabilities Act (ADA)
8. National Electric Safety Code (NESC)
9. NEC Article 110 – Flash Protection
10. International Building Code (IBC)
11. Rhode Island Fire Safety Code
12. University of Rhode Island Standards

1.06 PROTECTION AND CLEANING

A. All electrical equipment and devices in the existing building in which the electrical work is to be done under Contract, shall be protected from damages, scratches, paint, cement, etc. until the work is completed.

B. Where electrical equipment and/or devices are indicated to be abandoned and the Owner elects to salvage specific items, said items should be delivered to storage on site at a location designated by the Owner.

C. Exposed surfaces of electrical equipment & lighting fixtures shall be cleaned upon completion of the work.

D. All debris and material resulting from electrical work shall be removed from the property each and every day and shall be disposed of in a legal manner. Workspace shall be left clean as electrical work is completed.

E. Damages to covers and trims of electrical equipment shall be repaired and painted with touch-up paint supplied by the equipment manufacturer to the satisfaction of the owner's designated representative or the Architect or the equipment shall be replaced with new.

1.07 SHOP DRAWINGS

A. Definitions

1. Shop Drawings are information prepared by the Contractor to illustrate portions of the work in more detail than shown in the Contract Documents.

2. Coordination Drawings are detailed, large-scale layout Shop Drawings showing HVAC, Electrical, Plumbing and Fire Protection work superimposed in order to identify conflicts and ensure inter-coordination of Mechanical, Electrical, Architectural, Structural and other work.

B. Submittal Cover Sheet

1. Shop Drawings shall be submitted according to specification section with a separate cover sheet completed for each product, rather than one cover sheet for multiple products, whether or not supplied by one manufacturer or vendor.

C. Submittal Procedures and Format

1. Review submittal packages for compliance with the Contract Documents and then submit to Architect for review.

2. Provide additional copies of reviewed shop drawings as required for full distribution.

3. Shop Drawings showing layouts of systems shall contain sufficient plans, elevations, sections, details and schematics to describe work clearly. They shall be ¼" = 1' –0" scale unless specified otherwise. Sheet metal shop drawings shall be 3/8" = 1' –0 and shall indicate work of other sections where interferences are possible. Provide larger scale details as necessary. Sheet metal drawings shall show elements of Architects reflected ceiling plan, exposed ductwork, walls and partitions, diffusers, registers, grilles, fire dampers, sleeves and other aspects of construction as necessary for coordination.

4. ALL FIREWALLS AND SMOKE PARTIONS MUST BE HIGHLIGHTED ON THE SHEET METAL DRAWINGS FOR APPROPRIATE COORDINATION.

5. Shop drawings showing manufacturer's product data shall contain detailed dimensional drawings, accurate and complete description of construction materials, manufacturer's published performance characteristics and capacity ratings (performance data, alone, is not acceptable), electrical requirements and wiring diagrams. Drawings shall clearly indicate location (terminal block or wire number), voltage and function for all field terminations, and other information necessary to demonstrate compliance with all requirements of Contract Documents.

D. Acceptable Manufacturers

1. Alternate Manufacturers are acceptable only if, as a minimum, they:

a. Meet all performance criteria listed in the schedules and outlined in the specification.

b. Have identical operating characteristics to those called for in the specification.

c. Fit within the available space it was designed for, including space for maintenance and component removal, with no modification to either space or the product. Clearances to walls, ceilings and other equipment shall be at least equal to those shown on the design drawings.

d. For rooftop mounted equipment and for equipment mounted in areas where structural matters are a consideration, the products must have a weight no greater than the product listed in the schedules or specifications.

e. Products must adhere to all architectural considerations including, but not limited to: being of the same color as the product scheduled or

specified, fitting within architectural enclosures and details, and for diffusers, lighting and plumbing fixtures-being the same size and of the same physical appearance as schedule or specified products.

E. Deviations

1. Concerning deviations other than substitutions, proposed deviations from Contract Documents shall be requested individually in writing whether deviations result from field conditions, standard shop practice, or other cause. Submit letter with transmittal of Shop Drawings, which flags the deviation to the attention of the Architect.

2. Without letters flagging the deviation to the Architect, it is possible that the Architect may not notice such deviation or may not realize its ramifications. Therefore, if such letters are not submitted to the Architect, the contractor shall hold the Architect and his consultants harmless for any and all adverse consequences resulting from the deviations being implemented. This shall apply regardless of whether the Architect has reviewed or approved shop drawings containing the deviation, and will be strictly enforced.

3. Approval of proposed deviations, if any, will be made at the discretion of the Architect.

F. Responsibility

1. Intent of Submittal review is to check for capacity, rating, and certain construction features. Contractor shall ensure that work meets requirements of Contract Documents regarding information that pertains to fabrication processes or means, methods, techniques, sequences and procedures of construction; and for coordination of work of this and other Sections. Work shall comply with submittals marked “REVIEWED” to extent that they agree with Contract Documents. Submittal review shall not diminish responsibility under this Contract for dimensional coordination, quantities, installation, wiring, supports and access for service, nor shop drawing errors or deviations from requirements of Contract Documents. The Architect’s noting of some errors while overlooking others will not excuse the contractor from proceeding in error. Contract Documents requirements are not limited, waived nor superseded in any way by review.

2. INFORM SUBCONTRACTORS, MANUFACURERS, SUPPLIERS, ETC. OF SCOPE AND LIMITED NATURE OF REVIEW PROCESS AND ENFORCE COMPLIANCE WITH CONTRACT DOCUMENTS.

3. It shall be the responsibility of the Contractor to review all drawings and specifications thoroughly during BID process. The contractor shall notify the Engineer/Architect via RFI (request for information) if any conflicts arise. Failure to identify the discrepancies during the BID process shall disqualify the Contractor for claiming any additional compensation.

4. Shop drawings for entire distribution system will not be submitted until after the completion of the Short Circuit Study. Equipment AIC rating shall match with the results of the study.

G. Schedule: Incorporate shop drawing review period into construction schedule so that work is not delayed. Contractor shall assume full responsibility for delays caused by not incorporating the following shop drawing review time requirements into his project schedule. Working days listed reference the time in the Engineer's office. It does not include transmittal time for review each time shop drawing is submitted or resubmitted.

H. List of Proposed Equipment and Materials

1. Within four weeks after Award of Contract and before ordering materials or equipment, submit complete list of proposed materials and equipment and indicate manufacturer's names and addresses. No consideration will be given to partial lists submitted out of sequence.

I. Submit shop drawings in pdf format and electronically for the following:

1. Circuit breakers and enclosures
2. Disconnect Switches
3. Conduit, wire, feeders, cables and branch circuit wiring
4. Manual motor starters
5. Wire ways, outlet boxes, covers
6. Switches, receptacles, special purpose devices and plates
7. Lighting fixtures and lamps
8. Fire alarm system devices

1.08 SUBMITTAL DOCUMENTATION REQUIREMENTS

A. Furnish documentation associated with this bid proposal and Contract including submittals, shop drawings, O&M manuals, and test reports as follows. These requirements are in addition to submittal requirements stated elsewhere and shall not deprive the Owner of rights under other provisions of the Contract Documents.
1. Submit six (6) hard copies of documentation for review.
2. Submit documents in portable document format (PDF).
3. Submit documents in AutoCAD - Latest version for Drawings and Microsoft Word (latest version) for text format when requested.

B. Provide a Compliance Review of each section of the Specifications, Drawings and Addenda. The Compliance Review shall be a paragraph-by-paragraph review of the Specifications with the following information; "C", "D" or "E" marked in the margin of the original Specifications and any subsequent Addenda.

1. "C": Comply with no exceptions.
2. "D": Comply with deviations. For each and every deviation, provide a numbered footnote with reasons for the proposed deviation and how the intent of the Specification can be satisfied.
3. "E": Exception, do not comply. For each and every exception, provide a numbered footnote with reasons and possible alternatives.

C. Unless a deviation or exception is specifically noted in the Compliance Review, it is assumed that the Bidder is in complete compliance with the plans and Specifications.

Deviations or exceptions taken in cover letters, subsidiary documents, by omission or by contradiction do not release the Bidder from being in complete compliance, unless the exception or deviation has been specifically noted in the Compliance Review. Bidders may submit the latest state-of-the-art components and their standard control components in lieu of the specified items. The A/E and Owner will review deviations from the Specifications.

1.09 CONTINUITY OF SERVICES

A. Work under this section includes new work and work on existing systems within existing building. Perform such work so as not to interfere with the Owners operation. Where work necessitates interruption of service(s), schedule outages with the Owner and Engineer and perform the work at such time(s) as they shall direct. All shutdowns shall be conducted on off hours.

1.10 RECORD DRAWINGS

A. For the duration of the contract, the Electrical Contractor shall maintain a complete set of contract drawings. All completed work and all deviations from the contract documents shall be recorded clearly and accurately. Record drawings shall be turned over to the Owner upon completion of the work.

B. Electronic files are available to facilitate the preparation of Record Drawings. These files are solely for use of the Electrical Contractor and may not be a full representation of the Scope of work. These files are available from Wozny/Barbar & Associates, Inc. at a cost of $25.00 per drawing file.

1.11 COORDINATION

A. It shall be the responsibility of the Electrical Contractor to coordinate with all other trades and parties to avoid conflicts. No additional charges will be approved due to LACK OF COORDINATION OR FIELD VERIFICATION OF THE EXISTING CONDITIONS.

B. It shall be the responsibility of the Electrical Contractor to coordinate with all final connections of equipment with all sub-consultants including but not limited to plumbing, fire protection, mechanical, kitchen, pool, communication and security equipment and all other systems.

C. Refer to Architectural door hardware schedule for location of all low voltage devices.

1.12 TEMPORARY FACILITIES

A. The Electrical Contractor shall provide, at his own expense, his own field office. Furnish all tools, equipment, scaffolding and temporary construction required for the execution of the electrical work.

B. All scaffolding and other temporary construction shall be rigidly built in accordance with all local, state and federal requirements, and shall be removed from the premises upon completion of the work.

C. The Electrical Contractor shall provide all transformers, plywood, panel boards, wiring and other electrical equipment to support the needs of temporary light and power. Utilize new service entrance conduits for temporary power requirements where practical.

D. The Electrical Contractor shall coordinate with the General Contractor, the utility company and include all costs associated with the installation of telephones for the construction period. Include telephone service for all construction trailers.

1.13 MECHANICAL AND ELECTRICAL COORDINATION

A. Heating and Ventilating Subcontractor shall furnish and install various electrical items relating to the heating and ventilating equipment and control apparatus. The Electrical Subcontractor shall be required to connect power wiring to this equipment unless noted otherwise.

B. The Heating and Ventilating and Electrical Subcontractors shall coordinate their respective portions of the work, as well as the electrical characteristics of the heating and ventilating equipment.

C. All power wiring and local disconnect switches will be provided by the Electrical Subcontractor for the line voltage power. All control and interlocking wiring shall be the responsibility of the Heating and Ventilating Subcontractor.

D. 120V and above power wiring sources extended and connected to heating and ventilating control panels, transformers and switches shall be the responsibility of the Electrical Subcontractor. All low voltage thermostat, zone valve and any switch wiring shall be the responsibility of the Heating and Ventilating Subcontractor.

E. Temperature control and equipment wiring shall be installed by the Heating and Ventilating Subcontractor.

F. Pipe Tracing shall be furnished and installed by the specified subcontractor. Power connections shall be by the Electrical Subcontractor.

G. The Electrical Subcontractor will provide all magnetic starters except those furnished as an integral part of packaged equipment.

1.14 COORDINATION DRAWINGS

A. Before materials are purchased or work begun, the Electrical Contractor shall prepare coordination drawings showing the size and location of electrical equipment and conduit runs and other equipment related to the electrical work.

B. Coordination drawings are for the General Contractor's and the Engineer's use during construction and shall not be construed as replacing any shop, as built or record drawings required elsewhere in this Contract Document.

1.15 OPERATING INSTRUCTIONS AND MAINTENANCE MANUALS

A. Instruct to the Owner's satisfaction such persons as the Owner designates, in the proper operation and maintenance of the systems and their parts.

B. Furnish operating and maintenance manuals and forward same to the Engineer for transmittal to the Owner.

C. Operating instructions shall be specific for each system and shall include copies of posted specific instructions.

D. For maintenance purposes, provide Shop Drawings, parts lists, specifications and manufacturer's maintenance bulletins for each piece of equipment.

E. Provide name, address and telephone number of the manufacturer's representative and service company for each piece of equipment so that service or spare parts can be readily obtained.

1.16 WORKMANSHIP

A. The entire work installed in this Specification and as shown on the drawings shall be constructed and finished in every respect in a workmanlike and complete manner. It is the responsibility of the Electrical Contractor to install complete systems. All such parts as required completing the systems in accordance with the best trade practice and the satisfaction of the Owner's Engineer shall be installed.

B. Obtain detailed information from the manufacturers of apparatus as to the proper method of installing and connecting equipment. Obtain all information from the General Contractor and other Subcontractors, which may be necessary to facilitate work and the completion of the whole project.

C. Remove daily, all rubbish and debris and all refuse from workmen's lunches and at completion remove all his surplus materials, and leave in clean condition acceptable to the Owner's Engineer.

1.17 EXAMINATION OF SITE AND CONTRACT DOCUMENTS

A. Before submitting prices or beginning work, thoroughly make an examination of the site.

B. No claim for extra compensation will be recognized if difficulties are encountered which an examination of site conditions prior to executing contract would have revealed.

C. These specifications along with contract documents describe the electrical systems. The Electrical Contractor is required to provide complete and operating systems for all equipment mentioned.

D. Electrical equipment required for the successful operation of any of the particular types of Owner's equipment mentioned shall be furnished and installed.

E. Be responsible for all materials delivered to the site in connection with the work and pay all charges for cartage, scaffolds, planking, rigging and erecting. Take every precaution

necessary to protect equipment and installation in addition to plugging and protecting open ends of all pipes, outlet boxes, panel boxes, and junction boxes. All equipment shall be stored in a clean dry place to preserve the quality of material being used. Equipment and/or materials damaged during construction shall be replaced at no additional cost to the Owner. Any scaffolding over 8'-0" in height will be supplied by the General Contractor.

F. All materials and equipment required by this Specification shall be new, clean and free from defects at the time of installation. The Manufacturer and Underwriter's label shall appear on all material and equipment unless otherwise approved, in writing, by Owner.

1.18 SUBSTITUTION OF MATERIALS OR EQUIPMENT

A. If the Electrical Contractor wishes to use materials or equipment other than those specifically designated herein, as being equal to those so specifically designated: BEFORE PURCHASING AND/OR FABRICATION, he shall submit the proposed substitution in accordance with the requirements of the General Conditions, and the decision of whether or not it is equal to that specified shall be determined by the owner.

B. Unless requests for substitution are made in accordance with the above instructions and the instructions of the General Conditions, supported by sufficient proof of equality, the successful Contractor will be required to furnish specifically named items designated under the base bid.

C. If the apparatus or materials substituted for those specified necessitate changes or additional connections, piping supports or construction: same shall be provided and the Electrical Contractor shall assume the cost and the entire responsibility thereto.

D. The Electrical Contractor shall coordinate with the HVAC, Plumbing and Fire Protection Contractors with regard to feeder, raceway, and circuit breaker and disconnect switch sizes. If a substitution of HVAC, Plumbing and Fire Protection equipment is proposed by a Subcontractor, it shall become the responsibility of that Subcontractor to coordinate with the Electrical Contractor any and all changes with regard to feeder, raceway, and circuit breaker and disconnect switch sizes. The shop drawings shall clearly indicate what changes are required and any additional costs associated with this change. If coordination does not occur, the Subcontractor proposing the change shall be responsible for all costs that occur due to the substitution.

E. Whenever the Contractor secures approval for changing any items and such change involves a corresponding change or adjustment in any adjacent or related item, the responsibility for making the required change, or seeing that it is made, rests with the Contractor. The cost of these changes and/or adjustments shall be paid for by the Contractor unless it is otherwise agreed, in writing, at the time the change is approved. The acceptance of any change will not, in any way, relieve the Contractor from full compliance with the Contract Documents.

1.19 PERMITS, LAWS, ORDINANCES & CODES

A. The Electrical Contractor shall give all necessary notices, obtain all permits, and pay all taxes, fees and other costs in connection with his work; file all necessary plans, prepare all necessary documents and obtain all necessary approvals of state authorities, all local,

town, city or county departments having jurisdiction; obtain all required certificates of inspection for his work.

B. The Electrical Contractor shall include in the work, without extra cost to the Owner, any labor, materials, services, apparatus, drawings in addition to the drawings prepared by the Project Engineer and Documents, in order to comply with all applicable laws, ordinances, rules and regulations whether or not shown on the drawings and/or specified.

1.20 DAMAGE TO OTHER WORK

A. Each Contractor shall be held responsible for and shall pay for all damage to other work caused by his work or workmen.

B. Repairing of such damage shall be done by the General Contractor or Contractors who installed the work and so directed by the Owner's Engineer.

1.21 GUARANTEE

A. Attention is directed to provisions of the General Conditions and Special Conditions regarding guarantees and warranties for work under this Contract.

B. Electrical Contractor's guarantees shall be the same as the General Contractors.

C. All material, items of equipment and workmanship furnished under this section shall carry for this standard warranty against all defects in material and workmanship. Any fault due to defective or improper material, equipment, workmanship or design which may develop shall be made good, forthwith, by and at the expense of the Electrical Contractor, including all other damage done to areas, materials and other systems resulting from this failure.

D. Electrical Contractor shall guarantee that all elements of the systems are of sufficient capacity to meet the specified performance requirements as set forth herein or as indicated.

E. Upon receipt of notice from the Owner of failure of any part of the systems or equipment during the guarantee period, the affected part or parts shall be replaced by the Electrical Contractor at no additional cost to the Owner.

F. Furnish, before the final payment is made, a written guarantee covering the above requirements.

1.22 INSTALLATION REQUIREMENTS

A. The arrangement of all electrical work shown on the drawings is diagrammatic only and indicates the minimum requirements of the work. Conditions at the building including actual measurements shall determine the details of the installation. All work shall be laid out and installed so as to require the least amount of cutting and patching.

B. Check the Architectural plans and specifications before ordering any material and equipment. Any discrepancies shall be brought to the attention of the Architect for his determination prior to proceeding with the work.

1.23 TYPICAL DETAILS

A. Typical details where shown on the drawings shall apply to each and every item of the project where such items are applicable. They are not repeated in full on the drawings, which in many cases are diagrammatic only, but with the intention that such details shall be incorporated in full. Any alternate method proposed for use by the Contractor shall have the prior approval of the Architect.

1.24 TYPICAL PART PLANS

A. Typical part plan where shown on the drawings shall apply to each and every item of the project where such items are applicable. They are not repeated in full on the drawings, which in many cases are diagrammatic only, but with the intention that such details shall be incorporated in full. Any alternate method proposed for use by the Contractor shall have the prior approval of the Architect.

B. Where typical part plans are shown on the drawings, it is the Contractor's responsibility to install all wiring devices in accordance with State and National Codes. Where Architectural deviations occur, additional devices will be required and shall be the responsibility of the Contractor to confirm wall layouts with the latest Architectural floor plans.

1.25 SLEEVES, INSERTS

A. Furnish and install all sleeves, inserts, anchor bolts and similar items to be set into masonry or concrete, as required for mechanical and electrical work. Internal diameter of sleeve shall be 2" larger than the outside diameter of the pipe or insulation covered line passing through it.

1.26 CORING, DRILLING

A. Core, cut and/or drill all small holes 4.5" diameter or less in walls and floors required for the installation of sleeves and supports for the electrical work.

1.27 ACCESSIBILITY

A. Install all work such that parts, receptacles, equipment, devices etc. requiring periodic inspection, operation, maintenance and repair are readily accessible.

B. All GFCI receptacles shall be mounted in readily accessible location as required by NEC 210.8

C. Furnish all access panels appropriate to particular conditions, to be installed by trades having responsibility for the construction of actual walls, floors or ceilings at required locations.

1.28 TOOLS AND EQUIPMENT

A. Provide all tools and equipment required for the fabrication and installation of the mechanical and electrical equipment at the site.

1.29 PORTABLE AND DETACHABLE PARTS

A. Contractors shall retain in their possession all portable and/or detachable parts and portions of materials, devices, equipment etc. necessary for the proper operation and maintenance of the mechanical and electrical systems until final completion of the work, at which time they shall be handed over to the Owners.

1.30 RECORD DRAWINGS, PROJECT CLOSEOUT

A. As work progresses and for the duration of Contract, maintain a complete and separate set of prints of Contract Drawings at job site at all times. Record work completed and all changes from original Contract Drawings clearly and accurately including work installed as a modification or addition to the original design. Work shall be updated on a weekly basis and shall be made available for review by Architect. Failure to perform this work shall be reason for withholding requisition payments. In addition, take photographs of all concealed equipment in gypsum board ceilings, shafts, and other concealed, inaccessible work. At completion of work, make copies of photographs with written explanation on back. These shall become part of Record Documents.

B. At completion of work prepare a complete set of record drawings on diskette in the latest AutoCAD® Release 12 or higher format showing all systems as actually installed, including all fire alarm and electrical circuitry. The design tracings will be made available for the electrical contractor's copying, at his expense, into mylar reproducibles to serve as backgrounds for the drawings. The quantity of design tracings which are made available shall in no way be interpreted as setting a limit to the number of drawings necessary to show the required information. The Electrical Contractor's professional draftsperson shall transfer changes to mylars; submit mylars and three sets of prints to Architect for comments as to compliance with this section.

C. THE ARCHITECT WILL NOT CERTIFY THE ACCURACY OF THE RECORD DRAWINGS - THIS IS THE SOLE RESPONSIBILITY OF THE ELECTRICAL CONTRACTOR.

D. This trade shall submit the record set for approval by the fire and building departments in a form acceptable to the departments, when required by the jurisdiction.

E. Drawings shall show record condition of details, sections, riser diagrams, control changes and corrections to schedules. Schedules shall show actual manufacturer and make and model numbers of final equipment installation.

F. Refer to SECTION 01770 – CLOSEOUT PROCEDURES and 01782 – RECORD DOCUMENTS AND OWNER TRAINING sections

1.31 QUALITY ASSURANCE

A. The requirements of the State Building Code and local regulations establish the minimum acceptable quality of workmanship and materials, and all work shall conform thereto unless more stringent requirements are indicated or specified herein.

B. All work shall comply with the latest editions of the codes as referenced herein.

C. Follow manufacturer's directions for articles furnished, in addition to directions shown on drawings or specified herein.

D. Protect all work, materials, and equipment from damage during process of work. Replace all damaged or defective work, materials and equipment without additional cost to Owner.

E. All equipment and materials for permanent installation shall be the products of recognized manufacturers and shall be new.

F. Equipment and materials shall:

1. Where normally subject to Underwriters Laboratory Inc. listing or labeling services, be so listed or labeled.
2. Be without blemish or defect.
3. Not be used for temporary light and power purposes.
4. Be in accordance with the latest applicable NEMA standards.
5. By products which will meet with the acceptance of all authorities having jurisdiction over the work. Where such acceptance is contingent upon having the products examined, tested and certified by Underwriters or other recognized testing laboratory, the product shall be so examined, tested and certified.

G. Except for conduit, conduit fittings, outlet boxes, wire and cable, all items of equipment or material of one generic type shall be the product of one manufacturer throughout.

H. For items which are to be installed but not purchased as part of the electrical work, the electrical work shall include:

1. The coordination of their delivery.

2. Their unloading from delivery trucks driven into any point on the property line at grade level.

3. Their safe handling and field storage up to the time of permanent placement in the project.

4. The correction of any damage, defacement or corrosion to which they may have been subjected. Replacement if necessary shall be coordinated with Contractor who originally purchased the item.

5. Their field make-up and internal wiring as may be necessary for their proper operation.

6. Their mounting in place including the purchase and installation of all dunnage, supporting members, and fastenings necessary to adapt them to architectural and structural conditions.

7. Their connection to building wiring including the purchase and installation of all termination junction boxes necessary to adapt and connect them to this wiring. Included also shall be the purchase and installation of any substitute lugs or other wiring terminations as may be necessary to adapt their terminals to the building wiring as called for and to the connection methods set forth in these

specifications.

I. Items which are to be installed but not purchased as part of the electric work shall be carefully examined upon delivery to the project. Claims that any of these items have been received in such condition that their installation will require procedures beyond the reasonable scope of the electric work will be considered only if presented in writing within one week of the date of delivery to the project of the items in question. The electric work includes all procedures, regardless of how extensive, necessary to put into satisfactory operation, all items for which no claims have been submitted as outlined above.

1.32 DELIVERY, STORAGE, AND HANDLING

A. All materials for the work of this section shall be delivered, stored and handled so as to preclude damage of any nature. Manufactured materials shall be delivered and stored in their original containers, plainly marked with the products' and manufacturer's name. Materials in broken containers or in packages showing watermarks or other evidence of damage shall not be used and shall be removed from the site.

1.33 TEMPORARY POWER AND LIGHTING

A. Temporary lighting shall be based on a minimum of providing at least one 100 watt incandescent lamp for each 1,000 square feet of floor area. Sufficient wiring, lamps, and outlets shall be installed to insure proper lighting in all rooms, space, stairwells, and corridors. Minimum sized lamp used shall be 100 watt. Where higher lighting intensities are required by Federal or State Standards of Laws or otherwise specified, the above specified wattage shall be increased to provide these increased intensities. Refer to SECTION 01510 – TEMPORARY UTILITIES FOR ADDITIONAL WORK.

B. All necessary cables, panelboards, switches, temporary lamp replacements and accessories required for the temporary light and power installation shall be provided by the Electrical Subcontractor.

C. All temporary electrical work shall meet the requirements of the National Electrical Code Article 305 Temporary Wiring, the Local Utility Company, and all Federal Standards and Laws.

D. All temporary wiring and accessories thereto installed by the Electrical Subcontractor shall be removed after their purposes have been served.

E. The Owner will pay for the cost of electric energy consumed.

PART 2 - PRODUCTS

2.01 GENERAL

A. All materials and equipment necessary to make the installation complete in every detail shall be furnished and installed under this contract whether or not specifically specified herein. All materials and equipment shall be new. The Electrical Contractor shall include all wiring for mechanical, plumbing and fire protection systems, wiring protection systems and wiring for all equipment specified.

B. It is the intent of the Specifications that one manufacturer be selected, not a combination, for any particular system. For example, all wire of one manufacturer, all switches of one manufacturer, etc., except specific material classifications in which delivery time becomes a problem the Owner's Engineer may; give specific exemption from the requirements.

C. Where materials, equipment, apparatus or other products are specified by manufacturer, brand name, type or catalog number, such designation is to establish standards of performance, quality, type and style.

2.02 PULL BOXES, WIREWAYS, AND CHANNELS

A. Pull boxes shall be code gauge galvanized steel with screw covers to match. Pull boxes and wire ways shall be as shown on Drawings and/or as required by NEC and/or job conditions, with steel barriers separating systems.

B. Wire ways shall be galvanized steel, manufactured standard sections and fittings, with combination hinged and screw covers.

C. Steel channel supports shall be minimum 1-5/8 inch mold strip with minimum .105 inch wall thickness, Unistrut P1000, Kindorf, Husky Products, or equal.

2.03 RACEWAYS

A. Electric metallic tubing (EMT) shall be electro galvanized or sheradized steel. Tubing shall be as manufactured by Pyle National, Allied Tube and Conduit Corp., Wheatland Tube Company or equal.

B. All EMT shall be a minimum of 3/4" including branch circuits for lighting, power, data and telephone systems.

C. Intermediate metal conduit (IMC) shall be used where subject to damage.

D. Flexible metal conduit shall be galvanized steel with separate copper grounding conductor. Liquid-tight flexible metal conduit shall be similar, but with extruded moisture and oil proof outer jacket of polyvinyl chloride plastic. Flexible metal conduit less than 6-feet long may be used to connect all lighting fixtures. Motors and other equipment may be connected in length; not exceeding 18 inches. Liquidtight flexible metal conduit shall be used for all mechanical equipment or other rotating equipment subjected to moisture.

E. Couplings and connectors for electrical metallic tubing shall be galvanized steel set screw type.

F. Steel support rods or support bolts for conduits shall be 1/8" diameter for each inch or fraction thereof of diameter of conduit size, but no rod or bolt shall be less than 1/4" in diameter.

G. Conduit ends shall be cut square and reamed to remove burrs and sharp edges. Offsets and bends for changes in elevation of exposed conduit runs shall be made at walls or beams and not in open spaces between walls or beams. Conduits shall be routed so as not to interfere with the operation or maintenance of any equipment. The entire job shall be done in a neat and workmanlike manner, as approved by the Engineer. Steel supports or racks shall be galvanized steel channel and fittings, Unistrut, Kindorf, Husky Products Company, or equal.

H. Conduits shall be routed in the field so as to be coordinated with the building structure. Exposed conduit shall be run in straight lines parallel to walls, beams and columns and with right angle bends and threaded conduit fittings.

I. For 20 ampere branch circuit wiring furnish and install the number of individual conduits required to limit the number of conductors in each conduit to a number which will not require derating to a value below 100 percent of the current rating of the circuit over current protective device.

2.04 WIRE AND CABLE

A. All wire and cable shall be copper, minimum of #12 AWG solid.

B. Provide single conductor wire and cable with 600V insulation. Wire size #8 AWG and larger shall be stranded. Wire of size smaller than #8 AWG shall be solid. Conductors shall be soft drawn copper with conductivity of not less than 98% of ANSI Standard for annealed copper.

C. Wire and cable shall be Type THWN-THHN building wire, 600V, rated for 75 degrees C. in wet locations and 90 degrees C. in dry locations.

D. Flexible metal clad cable Type MC with green equipment ground may be used in areas above hung ceilings and in wall partitions where allowed by code. MC Cable shall be manufactured by AFC or equal.

E. Fire Alarm wiring shall be dual-rated fire alarm control cable rated @ 105 degrees C. for power limited fire protective signaling cable (Type FPL) and 90 degrees C. for non-power limited circuit cable (Type MC) installations. Cable shall be manufactured by AFC or equal.

F. Wire and cable shall be manufactured by Phelps Dodge Copper Products Corp., General Cable Co., Triangle Conduit and Cable Co., AFC/ A Monogram Co. or equal.

2.05 WIRING DEVICES

A. Available manufacturers: subject to compliance with requirements, manufacturers offering products that may be incorporated in the Work included, but not limited, to the following:

1. Wiring Devices

a. Pass and Seymour/Legrand
b. Bryant Electric
c. Cooper Industries
d. Hubbell
e. Leviton

B. Wiring devices and components shall be designed, manufactured, tested and installed to comply with FPA 70 (National Electrical Code), UL Standards: UL498 receptacles; UL20 switches; UL508 industrial control equipment; UL 943 ground fault circuit interrupters (2003 revision); and, UL 1449 surge suppressor; NEMA standards, state and local codes and requirements of authorities having jurisdiction. Federal specifications apply to certain receptacles (WC596) and switches (WS896). Furnish and install Federal Specification grade wiring devices, complete with all accessories as indicated on the drawings and as specified hereunder.

C. Color

1. As determined by Architect, except as otherwise indicated or required by code.

D. Duplex receptacles shall be Construction Grade Federal Specification rated for 125 volts, 20 amperes unless otherwise indicated on contract drawings and conform to WC596 standards. Receptacles shall have wire bundling clamps on all terminals including ground; terminal screws shall be #10. A full wrap-around steel bridge strap shall be provided with locking finger tabs to secure the face.

1. Pass & Seymour: CRB5362
2. Hubbell: CR5352
3. Leviton 5362S

E. Duplex receptacles with ground fault circuit interrupter characteristics shall be rated for 125 volts, 20 amperes with 20 ampere feed through amperes unless otherwise indicated on contract drawings, and shall conform to the revised 2003 UL 943 standard. All receptacles shall have “SafeLock” protection that will disconnect power to the receptacle if critical components are damaged and ground fault protection is lost. All receptacles shall have “trip indicator” light to identify a tripped condition. All receptacles in bathrooms/toilets, within 6’ 0” of sink locations, exterior outlets, utility vault, in wet areas, etc. shall be ground fault type whether indicated on the drawings or not. Provide weatherproof While-in-Use covers for exterior outlets.

1. Pass & Seymour: 2094
2. Cooper: XGF20
3. Leviton: 8898

F. Toggle switches shall be full sized, heavy duty AC type rated for 120/277 volts, 20 amperes and comply with Federal Specification WS 896. Mounting strap shall be one-piece nickel plated steel with integral ground. Terminals shall external screw-pressure plate back and side wired to accept # 14 - #10 AWG wire. Contacts shall be silver alloy.

	Single Pole	Double Pole	3-Way	4-Way	Locking
1. Pass & Seymour:	PS20ACI	PS20AC2	PS20AC3	PS20AC4	PS20AC-L
2. Hubbell:	HBL1221	HBL1222	HBL1223	HBL1224	HBL1221-L
3. Leviton:	1221-2	1222-2	1223-2	1224-2	1221-2L

G. Provide foam seals around all wiring device boxes in the building envelope.

2.06 WIRING DEVICE PLATES

A. All normal power wiring device plates shall be high impact nylon.

1. Pass & Seymour: TP Series (3/16 ” wider/longer than standard size; captive screws for single gang)

2. Hubbell: P Series

3. Leviton: 80700 Series

2.07 OUTLET BOXES AND ACCESSORIES

A. Provide galvanized sheet steel outlet boxes for all outlets unless otherwise noted.

B. Fixture outlet boxes shall have 3/8" solid male fixture studs and auxiliary fixture stems shall be supported from 3/8" male fixture studs.

C. All outlet boxes for concealed work shall be galvanized, stamped steel; those for fixtures, furnished with a fixture stud.

D. Outlet boxes shall be of size and type to accommodate (1) structural conditions; (2) size and number of raceways, conductors or cables entering and (3) devices or fixtures for which required.

E. Install blank plates on all outlet boxes, in which no apparatus is installed, which do not integrally provide a cover for the box.

F. Special care shall be taken to set all boxes correctly square and true with the building finish.

G. Outlet boxes and accessories shall be as manufactured by Steel City, Appleton, Raco or equal.

2.08 PANELBOARDS

A. Provide dead front lighting and power panel boards, with proper voltage and ampere rating as indicated. Panel boards shall be surface or flush mounted as specified in the panel schedules.

B. Provide bolt-on, molded case, circuit breakers with thermal - magnetic trips. Multiple pole breakers shall be single handle, common trip. Provide handle locks for emergency lighting circuits, fire alarm, security and other similar breakers. Main breakers shall be vertically mounted, separate from breakers.

C. Provide copper bus bars and full size insulated neutral bus. Panel buswork shall be rated to carry, as minimum, ampere rating of over current device that serves panel. Panels with see-thru bussing shall not be used. Provide anti-turn, solderless lugs suitable for copper wire.

D. Provide insulated, isolated ground bus for all isolated ground panelboards that serve computer equipment, furniture partitions and or as indicated on floor plans.

E. Provide fully rated circuit breakers equal to short circuit interrupting current available.

F. All circuit breakers in branch panels shall be coordinated for short circuit withstand and localizing a short circuit per NEC 240-12 without fuses.

G. Panel boards shall be manufactured by General Electric, Square D, Cutler Hammer or Siemens.

2.09 NAMEPLATES

A. Nameplates consisting of black plastic with white center, lettering to be 1/4" high, engraved through to white layer and properly fastened with brass screws shall be provided for the following equipment:

1. All panel boards and distribution equipment.

2. Terminal cabinets.

3. Junction boxes larger than 4-11/16".

2.10 DISCONNECT SWITCHES

A. All safety switches shall be NEMA Type HD and Underwriters' Laboratories listed.

B. All switches shall have switch blades which are fully visible in of OFF position with the door open. All current carrying parts shall be plated through electrolytic processed to resist corrosion and promote cool operation.

C. Switches shall be quick-make and quick-break such that, during normal operation of the switch, the operation of the contacts shall be not capable of being restrained by the operating handle after the closing or opening action of the contacts has started. The handle and mechanism shall be an integral part of the box, not the cover, with positive

padlocking provisions in the OFF position.

D. Switches shall be furnished in NEMA 1 general purpose enclosures unless NEMA 3R (raintight) or NEMA 4 as required by environment. Enclosures shall be of code gauge (UL 98) sheet steel (NEMA 1) or code gauge phosphate treatment and gray baked enamel finish.

E. Switches shall be horsepower rated for 600 volts AC and all switches shall be fused type with dual element fuses.

F. Safety switches shall be Square D Class 3130 or approved equal as manufactured by General Electric or Cutler Hammer.

2.11 FUSES

A. Fuses shall be non-renewable type, UL Class J up to 600 amp, and Class L over 600 amp. Fuses shall be current limiting type with a minimum interrupting rating of 200,000 rms amp.

B. Fuses shall not be used in any switchboards or panel boards unless adequate A.C. rated circuit breakers are not available.

C. Fuses shall be manufactured by Bussman, Gould Shawmut, Little Fuse or equal.

2.12 GROUNDING REQUIREMENTS

A. Ground all systems and equipment in accordance with best industry practice, the requirements of NFPA 70.

2.13 PHASING AND COLOR CODING

A. The insulation or covering of each wire or cable shall be color coded so as to provide for circuit identification as specified below:

120/208 V Circuits	277/480V	Phase Circuits
Black	Brown	A
Red	Orange	B
Blue	Yellow	C
White	Grey	Neutral
Green	Green w/yellow tracer	Equipment Ground

B. Color coding shall be achieved by one of the following methods:

1. The insulation or covering shall be coded during manufacture by use of one of the following methods:

   a. Colored compounds.
   b. Colored coatings.

2. In sizes and insulation types where factory applied colors are not available, wires and cables shall be color coded by the application of colored plastic tapes in

overlapping turns at all terminal points, and in all boxes in which splices are made.

C. The same colored cable shall be connected to the same phase throughout the project.

D. In general, building load centers and panelboards shall be phased "A", "B", "C", left to right. The neutral, although it may be in different locations for different equipment, shall be identified.

2.14 MOLDED CASE CIRCUIT BREAKERS

A. Molded case type circuit breakers shall consist of manually operated quick-make quick-break mechanically trip free operating mechanisms for simultaneous operation of all poles, with contacts, arc interrupters and trip elements for each pole, all enclosed in molded phenolic plastic cases.

1. Their tripping units shall be of the "thermal magnetic" type having bimetallic elements for time delay overload protection and magnetic elements for short circuit protection.

2. They shall be manually operable by means of toggle type operating handles having "tripped" position midway between the "on-off" position.

3. They shall each be contained in an individual case enclosing only the number of poles required for the particular breaker.

4. All panels and individually mounted circuit breakers shall have short circuit ratings exceeding the available short circuit or the values indicated in the Power System Studies in this section by a factor of 1.2 with a minimum as follows:

a. 240V class panels/breakers

1) 10 kAIC where shown fed by a 150 kVA or less transformer
2) 22 kAIC where shown fed by a 300 kVA or less transformer

b. 480V Class Panels/Breakers shall be 65 kAIC.

5. They shall be of the "bolted-in" type.

6. Where necessary, to accommodate other requirements, their frame sizes shall be increased to conform to such requirements, frame sizes being indicated only as a reference to the minimum acceptable interrupting ratings noted above.

7. Where single pole in trip sizes 20 amps or less, they shall be rated for switching duty.

8. They shall be equipped with 5 milliamp sensitivity ground fault interrupting features where so indicated.

B. They shall be manufactured by Square D, Cutler Hammer, or General Electric.

2.15 CARTRIDGE FUSES

A. Cartridge fuses shall be as follows:

1. Provide a complete set of fuses for each item of fusible type equipment. Fusible equipment furnished by other contractors will be complete with fuses.

2. Secondary system fuses, rated at 600 volts or less, shall be UL listed and constructed in conformance with the applicable standards set forth by NEMA and ANSI. All fuses of a particular class shall be of same manufacturer.

3. Regardless of actual fault current, they shall, at full recovery voltage, be capable of safely interrupting fault currents of 200,000 amperes RMS symmetrical or 340,000 amperes RMS asymmetrical, deliverable at the line side of the fuse.

4. Circuits 0-600 amperes shall be protected by the equal of Bussman "Low Peak" current limiting fuses, LPN-RK (250 volts), LPS-RK (600 volts), UL class RK-1.

5. Fuses shall be suitable for application to fuse gaps which reject other types of fusing.

6. Supply 10 per cent spare fuses of each size and type 60 amps and less. Supply three spare fuses for each size and type over 60 amps.

B. Cartridge fuses shall be manufactured by Bussman, Gould, or EFCO.

2.16 MOTOR CONTROLS

A. Motor Controls - Manual and Magnetic

1. Individually mounted magnetic starters shall be across-the-line type with thermal overload on each phase, single speed, two speed, or reduced voltage start as indicated. Check exact type of two speed or part winding motors to be furnished by other contractors, and provide proper starter.

2. Starters shall be of the replaceable contact double break type, of size and type required for particular motor horsepower and voltage. Minimum size starter to be size 1.

a. Starters shall have OL reset button, green pilot light to indicate "ON", and "HAND-OFF-AUTO" switch in cover. Pilot lights shall be push-to-test type.

b. Starters to have 120 volt control transformers with fused output being provided for those units operating on 277/480 volt system.

c. Provide proper rating of thermal overloads. Replace any overloads found to be of an incorrect rating. Provide a spare set of three thermal overloads for each starter.

d. Provide four (4) sets of auxiliary contacts of convertible type N.O. to N.C.

for each starter.

e. Motor starters installed in dry locations shall have NEMA I enclosures. Those in wet locations shall have NEMA IV enclosures.

f. Acceptable Manufacturers:

1) Allan Bradley
2) General Electric
3) Cutler Hammer
4) Square D

3. Manual motor starters shall have pilot lights and shall be furnished with thermal overloads on each phase.

B. Motors: Each motor shall have disconnect switch and starter provided under this section. Starters which are a part of "factory assembled" control panel will be provided under section supplying equipment to be controlled but connected under this section.

1. Provide motor terminal boxes for each motor not furnished with same.

C. Disconnect Switches

1. Disconnect (safety) switches shall conform to industrial standards of NEMA, be UL listed and shall be heavy duty type, quick-make, quick-break type with interlocking cover mechanism and provisions for padlocking switch handle in "OFF" position. Three pole toggle switches are not acceptable as substitute for disconnect switches.

2. Disconnect switches shall be of fused or unfused type as indicated with number of disconnecting poles indicated. The grounded conductor shall not be switched. Switches shall be for use with current limiting fuses with rejection type fuse clips and those shall be horsepower rated.

3. Enclosures shall be of proper NEMA type for the intended location and shall be phosphate coated or equivalent code gauge galvanized sheet steel with gray baked enamel finish.

4. Acceptable Manufacturers

a. General Electric
b. Cutler Hammer
c. Square D

D. Combination Starter

1. Provide combination starters where indicated on the plans.

E. Motor Control Circuitry

1. Except as noted below, select materials exactly as specified for feeders. Utilize No. 12 AWG THWN conductors throughout minimum.

2. Motor control circuit wires may be run in the same conduit as the wires of motor power circuits; however, exclude motor control wires from enclosures (other than

motor starter enclosures) which contain power circuit overcurrent protection and switching devices; also from pull boxes and junction boxes containing the wires of main and submain feeders. Utilize auxiliary pull boxes to separate motor control wires from motor power circuit wires before the power circuit wires enter the items from which motor control wires are excluded.

3. Prior to installing any motor control circuitry for a particular motor, notify the Architect of any deviations between the control circuitry requirements of the trade supplying the motor and the indicated electric work.

2.17 LIGHTING FIXTURES

A. Furnish all labor, materials and equipment required for a complete installation of lighting equipment specified.

B. This Contractor shall assume all responsibility for the safe handling of all lighting fixtures, which are furnished under this Section and other accessories and lamps, until the final inspection has been made by the Owner's Engineer.

C. Special fittings and materials that may be required to support fixtures shall be supplied as well as supports or grounds required securing surface or pendant mounted fixtures on suspended ceilings unless otherwise noted. Where ductwork, pipes, type of building construction materials and structural framing members provide obstructions or difficult support means, hanger rods shall be used in association with horizontal sections of steel support channels in a manner approved by the Owner's Engineer. Steel support channels shall be Unistrut, Kindorf, Husky Products Co., or equal. The exact mounting height of all stem supported lighting fixtures shall be determined on the job, by the Owner's Engineer.

D. Fixtures, part or parts thereof (including lamps) determined to be defective upon completion of the electrical installation shall be replaced by the Electrical Contractor free of charge.

E. In addition to fixture supports, surface mounted lighting fixtures shall be secured to the surface to which they mount at a minimum to two points on each 4 foot length of fixture housing, as approved, to prevent rotation or movement of the fixture out of its square and level position of alignment.

F. This Contractor shall include all fixtures, wiring, hanging, uncrating, connecting up and making ready for operation. This Contractor shall include the cost of furnishing and installing all lamps for all fixtures under this Contract.

G. All light fixtures installed in suspended ceilings shall be supported from the building structure by chains at either end of fixture.

H. All fixtures installed in insulated ceilings shall be IC rated. Coordinate with the Architects reflected ceiling plans.

I. All fixtures installed in rated ceilings shall be one or two hour rated. Coordinate with the Architects reflected ceiling plans for ceiling rating.

J. All lighting fixtures shall be individually supported from the structural slab or structural building member. Fixtures will not be permitted to be supported from suspended ceiling or roof deck. Fixtures shall be supported in accordance with seismic requirements outlined in the International Building Code.

2.18 OCCUPANCY SENSORS

A. Work Included

1. Contractor's work to include all labor, materials, tools, appliances, control hardware, sensor, wire, junction boxes and equipment necessary for and incidental to the delivery, installation and furnishing of a completely operational occupancy sensor lighting control system, as described herein.

2. Contractor/Supplier shall examine all general specification provisions and drawings for related electrical work required as work under Division 16.

3. Contractor shall coordinate all work described in this section with all other applicable plans and specifications, including but not limited to wiring, conduit, fixtures, HVAC systems and building management systems.

B. Equipment Qualification

1. Products supplied shall be from a single manufacturer that has been continuously involved in the manufacturing of occupancy sensors for a minimum of five (5) years. Mixing of manufacturers shall not be allowed.

2. All components shall be U.L. listed, offer a five (5) year warranty and meet all state and local applicable code requirements.

3. Products shall be manufactured by an ISO 9002 certified manufacturing facility and shall have a defect rate of less than 1/3 of 1%.

4. Wall switch products must be capable of withstanding the effects of inrush current. Submittals shall clearly indicate the method used.

C. System Description

1. The objective of this section is to ensure the proper installation of the occupancy sensor based lighting control system so that lighting is turned off automatically after reasonable time delay when a room or area is vacated by the last person to occupy said room or area.

2. The occupancy sensor based lighting control shall accommodate all conditions of space utilization and all irregular work hours and habits.

3. Contractor shall warrant all equipment furnished in accordance to this specification to be undamaged, free of defects in materials and workmanship, and in conformance with the specifications. The supplier’s obligation shall include repair or replacement, and testing without charge to the owner, all or any parts of equipment which are found to be damaged, defective or non-conforming

and returned to the supplier. The warranty shall commence upon the owner's acceptance of the project. Warranty on labor shall be for a minimum period of one (1) year.

D. Submittals

1. Manufacturer shall substantiate conformance to this specification by supplying the necessary documents, performance data and wiring diagrams. Any deviations to this specification must be clearly stated by letter and submitted.

2. Submit a lighting plan clearly marked by manufacturer showing proper product, location and orientation of each sensor.

3. Submit any interconnection diagrams per major subsystem showing proper wiring.

4. Submit standard catalog literature, which includes performance specifications indicating compliance to the specification

5. Catalog sheets must clearly state any load restrictions when used with electronic ballasts.

E. System Operation

1. It shall be the contractor's responsibility to make all proper adjustments to assure owner's satisfaction with the occupancy system. Unless specified otherwise, the contractor shall set all time delays to no less than 15 (fifteen) minutes. Or;

a. Factory Commissioning

1) It shall be the manufacturer's responsibility to verify all proper adjustments and train owner's personnel to ensure owner's satisfaction with the occupancy system. This service is provided at an additional cost.

F. Acceptable Manufacturers

1. Hubbell Building Automation, Watt Stopper or Pre-Approved Equal: For pre-approval, provide all the information listed under section 1.04A and 1.04D a minimum of ten (10) working days prior to initial bid date.

2. The listing of any manufacturer as "acceptable" does not imply automatic approval. It is the sole responsibility of the electrical contractor to ensure that any price quotations received and submittals made are for sensors, which meet or exceed the specifications included herein.

G. Products

1. All products shall be Watt Stopper product numbers:

   a. Ceiling Sensors:

      W-500A, W-1000A, W-2000A, W-2000H, WPIR, DT-200, DT-205, DT-300, DT-305, DT-355, CX-100, CX-105, CI-200, CI-205, WT600, WT-05, WT1100, WT-1105, WT2200, WT-2205, WT-2250, HB-100, HB-150

   b. Wall Sensors:

      WI-200, WI-300, WS-200, WA-200, WA-300, WD-170, WD-180, WD-270, WD-280, WN-100

   c. Power and Slave Packs:

      B120E-P, B277E-P, A120E-P, A277E-P, A120C-P, A277C-P, C120E-P, C277E-P, S120/277-P, AT-120, AT-277, BZ-100

   d. Low Temperature: CB-100 Outdoor Sensors: EW, EN series.

   e. InteliSwitch: TS-400, TS-400-24, AS-100, AS-110

   f. Daylighting Controls: LCO, LCD, LCE, LS-100, LS-301.

2. Wall switch sensors shall utilize Passive Infrared sensing technology only to detect motion.

3. Wall switch sensors shall be capable of detection of occupancy at desktop level up to 300 square feet, and gross motion up to 1000 square feet.

4. Wall switch sensors shall accommodate loads from 0 to 800 watts at 120 volts; 0 to 1200 watts at 277 volts and shall have 180˚ coverage capability.

5. Wall switch products shall utilize Zero Crossing Circuitry, which increases relay life, protects from the effects of inrush current, and increases sensor's longevity.

6. Wall switch sensors shall have no leakage current to load, in manual or in Auto/Off mode for safety purposes and shall have voltage drop protection.

7. Where specified, wall switch sensors shall provide a field selectable option to convert sensor operation from automatic-ON to manual-ON.

8. Where specified, vandal resistant wall switch sensors shall utilize a hard lens with a minimum 1.0mm thickness. Products utilizing a soft lens will not be considered.

9. Passive infrared sensors shall utilize Pulse Count Processing and Digital Signature Analysis to respond only to those signals caused by human motion.

10. Passive infrared sensors shall utilize mixed signal ASIC which provides high immunity to false triggering from RFI (hand-held radios) and EMI (electrical noise on the line), superior performance, and greater reliability.

11. Passive infrared sensors shall have a multiple segmented Lodif Fresnel lens, in a multiple-tier configuration, with grooves-in to eliminate dust and residue build-up.

12. Where specified, passive infrared and dual technology sensors shall offer daylighting foot-candle adjustment control and be able to accommodate dual level lighting.

13. Dual technology sensors shall be corner or recessed mounted to avoid detection outside the controlled area when doors are left open. Sensors shall have “auto on” or “manual on” feature.

14. Dual technology sensors shall consist of passive infrared and ultrasonic technologies for occupancy detection. Products that react to noise or ambient sound shall not be considered.

15. Ultrasonic sensors shall utilize Advanced Signal Processing to adjust the detection threshold dynamically to compensate for constantly changing levels of activity and airflow throughout controlled space.

16. Ultrasonic operating frequency shall be crystal controlled to within plus or minus 0.005% tolerance to assure reliable performance and eliminate sensor cross-talk. Sensors using multiple frequencies are not acceptable.

17. All sensors shall be capable of operating normally with electronic ballasts, PL lamp systems and rated motor loads.

18. Coverage of sensors shall remain constant after sensitivity control has been set. No automatic reduction shall occur in coverage due to the cycling of air conditioner or heating fans.

19. All sensors shall have readily accessible, user adjustable settings for time delay and sensitivity. Settings shall be located on the sensor (not the control unit) and shall be recessed to limit tampering.

20. In the event of failure, a bypass manual override shall be provided on each sensor. When bypass is utilized, lighting shall remain on constantly or control shall divert to a wall switch until sensor is replaced. This control shall be recessed to prevent tampering.

21. All sensors shall provide an LED as a visual means of indication at all times to verify that motion is being detected during both testing and normal operation.

22. Where specified, sensor shall have an internal additional isolated relay with Normally Open, Normally Closed and Common outputs for use with HVAC control, Data Logging and other control options. Sensors utilizing separate components or specially modified units to achieve this function are not acceptable.

23. All sensors shall have UL rated, 94V-0 plastic enclosures.

H. Circuit Control Hardware - CU

1. Control Units - For ease of mounting, installation and future service, control unit(s) shall be able to externally mount through a 1/2" knock-out on a standard electrical enclosure and be an integrated, self-contained unit consisting internally of an isolated load switching control relay and a transformer to provide low-voltage power. Control unit shall provide power to a minimum of two (2) sensors.

2. Relay Contacts shall have ratings of:

   a. 13A - 120 VAC Tungsten
   b. 20A - 120 VAC Ballast
   c. 20A - 277 VAC Ballast

3. Control wiring between sensors and controls units shall be Class II, 18-24 AWG, stranded U.L. Classified, PVC insulated or TEFLON jacketed cable suitable for use in plenums, where applicable.

4. Minimum acceptable wire gauge from the circuit control hardware relays shall be #14 AWG.

I. Installation

1. It shall be the contractor's responsibility to locate and aim sensory in the correct location required for complete and proper volumetric coverage within the range of coverage(s) of controlled areas per the manufacturer's recommendations. Rooms shall have ninety (90) to one hundred (100) percent coverage to completely cover the controlled area to accommodate all occupancy habits of single or multiple occupants at any location within the room(s). The locations and quantities of sensors shown on the drawings are diagrammatic and indicate only the rooms, which are to be provided with sensors. The contractor shall provide additional sensors if required to properly and completely cover the respective room. Power/switch packs may or may not be indicated on the drawings. It shall be the contractor’s responsibility to provide and install all power/switch packs required to make the system fully operational. Locations of power/switch packs may be determined in the field by the contractor unless specified otherwise, but must be readily accessible for future servicing. Usually, a minimum of one (1) power/switch pack is required per circuit and/or area of control. However, in some cases additional power/switch packs may be required. Contact manufacturer for final determination of power/switch packs required for this project.

2. It is the contractor’s responsibility to arrange a pre-installation meeting with the manufacturer's factory authorized representative, at the owner's facility, to verify placement of sensors and installation criteria.

3. Proper judgment must be exercised in executing the installation so as to ensure the best possible installation in the available space and to overcome local difficulties due to space limitations or interference of structural components. The contractor shall also provide, at the owner's facility, the training necessary to

familiarize the owner's personnel with the operation, use, adjustment, and problem-solving diagnosis of the occupancy sensing devices and systems.

J. Factory Commissioning

1. Upon completion of the installation, the system shall be completely commissioned by the manufacturer's factory authorized technician who will verify all adjustments and sensor placement to ensure a trouble-free occupancy-based lighting control system. This service is provided at an additional cost.

2. The electrical contractor shall provide both the manufacturer and the electrical engineer with 15 working days written notice of the scheduled commissioning date. Upon completion of the system fine-tuning the factory authorized technician shall provide the proper training to the owner's personnel in the adjustment and maintenance of the sensors. The contractor shall provide all lifts and/or ladders and one technician to assist in the commissioning. Prior to commissioning, the contractor shall verify that all sensors and associated power supplies/relays are installed and all wiring properly terminated.

3. The system must be completely operational and all time delays adjusted per the specification

4. The manufacturer’s factory authorized technician shall, upon completion of the commissioning, provide a written report to the electrical contractor and the electrical engineer indicating completion of the work.

5. This report shall also indicate any corrective actions required on the part of the electrical contractor to the system.

2.19 FIRE ALARM SYSTEM – EXTENSION

A. General: The present building is equipped with an addressable fire alarm system manufactured by FCI. The Renovations fire alarm system shall be an extension of this system, integrated to provide a complete complex system.

1. Furnish and install an addition to the existing closed circuit, electrically supervised automatic and manual, (zone coded) local energy, auxiliary fire alarm system, according to the following Specification. The system shall be wired, connected, tested and left in first class operating condition. The equipment and completed installation shall be in compliance with local and national codes, authorities having jurisdiction and in accordance with applicable sections of the latest edition of NFPA 72 for auxiliary fire alarm systems. All equipment shall be listed by Underwriters' Laboratories, Incorporated and shall meet Americans with Disabilities Act (ADA), NFPA72 and with the approval of the State Fire Marshal.

2. Contractor shall provide a budgetary allowance for fire watch in his bid. If the existing system is off-line for more than 4 hours the Contractor shall be responsible to negotiate with local AHJ for hours, fees and number of personnel to perform the fire watch with associated project. No additional compensations shall be permitted.

3. All new equipment shall be provided by the manufacturer of the existing equipment for complete number compatibility with the existing system and to provide one (1) manufacturer with total responsibility for the entire system operation, warranty and maintenance. No other manufacturer will be considered acceptable. Match existing devices to whatever extent is possible.

4. All final connections, programming, testing and adjusting of the system shall be done under the direct supervision of the system supplier. After completion of the installation, a trained technician employed by the system supplier shall demonstrate the system to be satisfaction of the Owner's Representative and shall make all additional adjustments to the system operation as required by the Owner's Representative as a result of this demonstration.

5. Warrant the new equipment to be free from defects in material and workmanship and within one (1) year from date of installation, repair or replace all or any part of the equipment found to be defective at no cost to the Owner.

B. Shop Drawings

1. System Shop Drawings are required to be submitted for approval, containing the following information:

   a. A detailed list of each new piece of equipment with model numbers for each component.
   b. Manufacturer's Specification Sheets on each item of equipment.
   c. Confirmation that the manufacturer's representative will provide jobsite supervision during the installation of the system, perform the final testing of the system and instruct the operating personnel on the operation of the system.
   d. Detailed one (1) line schematic wiring diagrams of the system and its interconnecting wiring. Typical wiring diagram will not be accepted. All data submitted shall be complete for all equipment and shall apply only to this specific project. All extraneous material shall be deleted.
   e. Provide revised battery and circuit calculations reflecting all new and existing devices. Circuit calculations shall demonstrate proper consideration of wire size, circuit loading and spare capacity allowances.
   f. Shop Drawings that are submitted for approval without all of this information will not be considered for approval.

C. Operation

1. The activation of any manual fire alarm station or the automatic actuation of any thermal detector, ceiling smoke detector, duct smoke detector, sprinkler system water flow switch or any other approved alarm initiating device shall immediately result in the following:

   a. The existing master box shall trip, causing the Fire Department to be notified.
   b. The zone in alarm shall light its respective alarm lamp or display the appropriate alarm message on the system LCD at the fire alarm control panel and at all remote fire alarm annunciators.

c. All audible alarm signals (existing and new) shall sound, and all visual units shall flash in a synchronized fashion.
d. All smoke doors (existing and new) shall automatically close.
e. Upon activation of an elevator lobby smoke detector or other designated recall device, recall all elevators to the ground floor or an alternate level as required by the local authority having jurisdiction. Provide for shunt tripping of elevator power as shown and in accordance with applicable codes.

2. Certain duct smoke detectors shall activate damper control circuits as indicated in addition to their fire alarm system function.

3. Provide 24 volt DC power to the new LCN door closers from the fire alarm control panel.

D. Equipment

1. Fire Alarm Control Panel

a. Modify and expand the existing fire alarm control panel to provide for proper system operation from both new and existing devices. Provide new control panel modules incorporated into the existing cabinets, with 200 percent extra cabinet capacity for future system expansion capability. The operating controls and zone and supervisory indicators shall be located behind a locked door with a full size tempered glass viewing window. All control modules shall be labeled, all zone locations shall be identified and the panel shall be provided with a set of permanently mounted operating instructions. The panel shall contain the following modules.

b. A control module shall be provided to act as a central processing and indicating location for the fire alarm system. It shall include acknowledge, reset, LED test and trouble silence switches, annunciator trouble, system trouble and earth LED's and a trouble sonalert and an alphanumeric LCD. The control module shall also be provided with an alarm resound feature to permit subsequent alarms to resound the signals.

c. Provide Class "A" four (4) wire loop style alarm initiating circuit modules with two (2) electrically supervised, normally open circuits, monitoring for alarm (shorts), trouble (opens) and ground faults. The modules shall provide alarm and trouble LED's, LED test (from control), alarm annunciator outputs and alarm resound with flasher acknowledge (from control). They shall also be equipped with zone test and disconnect switches which match the existing configuration. They shall allow the mixing of smoke detectors, heat detectors, flow switches and other initiation devices on the same zone, without the use of limiting resistors at manual stations and detectors and without using a separate source of power for the detectors.

d. Provide Class "A" four (4) wire loop style notification appliance circuit modules for control and supervision of the audible and visual signals. Each signal circuit shall have a trouble LED and fuse. Supervision shall be provided for opens, shorts and earth grounds.

e. Provide adequate power supply module supplying 6 amperes each of continuous filtered power. The power supply shall be capable of furnishing the system power and power for devices such as duct smoke detectors, auxiliary relays, door holders, and notification appliances, etc. It shall contain a normal power LED, battery trouble LED and power supply trouble LED, all viewable on front of enclosure. Where power supplies are in separate or remote enclosures, they shall be supervised by the FACP for loss of AC power, battery fail, and ground fault, and each notification appliance circuit served shall be individually supervised.

f. Provide terminal connectors and harnesses for field connections of remote annunciators, or for the modules' auxiliary contacts. Each connector shall have provisions for at least sixteen (16) separate points and shall be fastened securely on the rack end.

g. Provide any and all modules and modifications including system programming to the fire alarm control panel necessary for proper system operation.

h. Manual Fire Alarm Stations

1) Match existing double action, semi-flush, non-coded stations shall be furnished where shown on Plans. A downward pull of the lever shall actuate a positive snap action switch. Station shall remain actuated until the station is reset by means of a key furnished with each station.

i. Thermal Detectors

1) Furnish and install, where shown, the following low profile, matte white:

a) 135^{o}F rate of rise fixed temperature type.
b) 190^{o}F fixed temperature type.

j. Smoke Detectors

1) Furnish and install, where indicated on the Plans, microprocessor-based analog/addressable photoelectric smoke detectors which match existing devices.
2) Detectors shall be listed by Underwriters' Laboratories, Incorporated under the current standards for photoelectric type smoke detectors, UL 268.
3) Each detector shall be designed to latch into alarm following a predetermined alarm verification time allowance. An alarm condition shall be indicated by a red LED indicator. Supervised remote LED alarm indicators shall be connected to detectors where shown on the Plans.
4) For ease of maintenance and installation, detectors shall utilize a separate base assembly having screw terminals for external wire connections. The base assembly shall mount on a standard 4 inches (10.16cm) square or 4 inches (10.16cm) octagonal outlet box.

5) Provide a base with each smoke detector, except for locations requiring auxiliary functions. Provide a base with integral auxiliary relay for those locations.

k. Duct Mounted Smoke Detectors

1) Furnish and install photoelectric air duct smoke detectors which match existing to operate directly from the fire alarm panel power supply. It shall have a detection chamber capable of being removed without breaking conduit connections or requiring an access panel in the duct. Each detector shall have a remote test and annunciating station. The detector shall have two associated programmable alarm relay contacts

l. Programmable Modules

a) Furnish and install addressable monitor modules to monitor waterflow, tamper or other related dry contact status inputs.
b) Furnish and install addressable control modules to provide programmable auxiliary contact outputs from the system. Each contact shall be rated for 2 amps @24VDC or .5 amps @ 120VAC.

m. Audio Visual Alarm Signals

1) Furnish and install combination audio/visual alarm assemblies, except where noted.
2) Audible signals shall match existing and produce a sound output of 85dba at 10 feet, or 15dba above ambient; whichever is greater.
3) Provide xenon strobe visual signals with a minimum effective intensity of 15 candela or otherwise shown or required in accordance with UL1971, ADA and NFPA72.

E. Installation

1. Furnish and install, in accordance with manufacturer's instructions, all wiring, conduit and outlet boxes required for the installation of the complete system as specified and described herein and as shown on the Drawings. Ensure that any new work or wiring performed within the new area shall in no way impair or adversely affect the performance of the existing building's fire alarm system in areas adjacent to the new area.

2. All wiring shall be of the same approved type as used for electric light and power wiring and shall meet the requirements of National Electric Codes. The sizes of the different wires shall be no smaller than #14 AWG. Color codes shall be used throughout. All wires shall be tagged at all junction points and shall test free from grounds or crosses between conductors. The wiring color code system shall be carried right through all equipment.

3. Final connections between the new equipment, the wiring system (and the existing equipment) shall be made under direct supervision of a Factory-Trained Manufacturer’s Representative.

F. Manufacturer's Guarantee and Final Test

1. The Installing Contractor shall guarantee all equipment and wiring free from inherent mechanical and electric defects for a period of one (1) year from date of final test and acceptance form.

2. The manufacturing, supplying and servicing company of the previously specified system shall be a single responsibility. All equipment shall carry the original manufacturer's label, part number and UL/FM listing. Multiple suppliers will not meet the intent of a single responsibility for the total system concept.

3. The manufacturer of this equipment shall maintain local offices within fifty (50) miles of installation for prompt and efficient service when required. Manufacturers without local service facilities and equipped accordingly shall not be considered equal under these Specifications.

4. Provide a complete final test and recertification of the modified system if accordance with NFPA72 and UL procedures. The tests shall be witnessed and conducted under the direction of the local Authority Having Jurisdiction. A complete test report, riser diagram, address directory and as-built drawings and UL certificate shall be provided as part of the final as-built documentation.

PART 3 - EXECUTION

3.01 SPECIAL COORDINATION INSTRUCTIONS

A. Coordination with the work of other trades is referred to within various parts of this Section of the Specifications. The following special instructions shall also be carefully noted:

1. Locations and mounting height of all wall outlets and lighting fixtures shall be as specified on the electrical, architectural drawings, and as required by the latest edition of national and local codes.

2. All feeder, branch circuit or auxiliary system wiring passing through pull boxes and/or being made up in panel boards shall be properly grouped, bound and tied together in a neat and orderly manner in keeping with the highest standards of the trade, with plastic cable ties.

3. All duplex convenience and power receptacles shall be mounted vertically with the grounding post to the bottom as the outlet is viewed from the front.

4. All miscellaneous hardware and support accessories, including support rods, nuts, bolts, screws and other such items shall be of a galvanized or cadmium plated finish, or of other approved rust-inhibiting coatings. Care should be taken that fixtures shall not be installed on both sides of existing or new building expansion joints.

5. The Electrical Contractor shall provide all materials, equipment and workmanship to provide for adequate protection of all electrical equipment during the course of construction of the project.

6. The Electrical Contractor shall furnish and install approved details for all insulation at terminal connection points for all electrical conducting materials, such as transformer terminals, terminal studs, and at any other special locations as directed by the Engineer and confirmed by the Owner.

7. The Electrical Contractor shall provide GFI rated and weatherproof rated equipment in damp or wet locations. All GFCI receptacles shall be mounted in readily accessible location as required by NEC 210.8

8. Coordination with local utility companies with the local utility companies and the local Fire Department is required. Electrical Contractor shall obtain all necessary permits and file all required applications and meet all utility company requirements.

9. Any outlet box shall not be mounted back to back on any wall of any rotating. Maintain the code clearances when boxes are mounted back to back.

3.02 COOPERATION AND WORK PROGRESS

A. The electrical work shall be carried on under the usual construction conditions, in conjunction with all other work at the site. The Electrical Contractor shall cooperate with

the Engineer and all contractors and equipment suppliers working on the site coordinate the work and proceed in a manner so as not to delay the progress of the project.

B. The Electrical Contractor shall be responsible to coordinate the exact mounting arrangement and location of equipment indicated on the drawings to allow for proper space requirements for equipment access, operation and maintenance.

C. It shall be the responsibility of the Electrical Contractor to coordinate the delivery of electrical equipment to the project prior to the time of installation or equipment.

3.03 INSTALLATION OF WIRING & CONDUIT

A. In general, all conduits shall be run concealed unless otherwise indicated to be run exposed.

B. Exposed conduits shall be run parallel to or at right angles to the walls of the building and all bends shall be made with standard conduit ells or conduits bent to, not less than, the same radius. Horizontal runs of exposed conduits shall be close to ceiling beams, passing over water or other piping where possible and shall be supported by pipe straps or by other approved means, not more than 5' apart. Installation of exposed conduits in finished areas of the building shall be checked with the Engineers, Architect, and Owner for layout before installation to conform to the pattern of the structural members, and when completed, is to present the most obtrusive appearance possible. No exposed conduits will be permitted on walls or partitions in public areas.

C. In no place shall a conduit be run within 3" of hot water pipes or appliances, except where crossing is unavoidable, and in that case, the conduit shall be kept at least 1" from covering or pipe crossed.

D. Conduits shall be supported on approved galvanized wall brackets, ceiling trapeze, strap hangers or pipe straps, secured by means of toggle bolts on hollow masonry units or expansion bolts in concrete or brick.

E. In general, no splices or joints will be permitted in either feeder or branches except at outlets or accessible junction boxes. No splices shall be made in security or fire alarm systems.

F. All splices in wire #8 AWG and smaller shall be standard pigtail, made mechanically tight and insulated with proper thickness of insulating tape. Wire splicing nuts as manufactured by; Minnesota Mining Company (Scotch Lock) or Ideal wire nuts shall be used, subject to the local wire inspector.

G. Wire #6 and larger shall be connected to panels and apparatus by means of approved lugs or connectors. Connectors shall be solderless type, sufficiently large to enclose all strands of the conductor and securely fastened.

H. Provide (3) 1-inch conduits from each electrical panel up to the nearest lay-in ceiling area.

3.04 GROUNDING

A. For each feeder or run of lighting and appliance branch circuitry include equipment and raceway grounding conductors run within the raceways. The indicated quantities of conductors do not include the ground wires.

B. Conductors utilized for grounding and bonding shall have type of insulation, comparable to the phase conductors, color coded green.

3.05 TEMPERATURE CONTROL WIRING

A. The temperature control system shall be installed by the Heating and Air Conditioning Contractor.

B. All electric wiring and wiring connections required for the installation of the temperature control system shall be provided by the Temperature Control Contractor.

C. Electrical Contractor shall provide 120-volt control power to all temperature control panels. Provide a 120V, 20A circuit from local 120V panel to a ceiling mounted junction box located in each mechanical space.

3.06 SLEEVES, INSERTS, AND SUPPORTS

A. Furnish and install all inserts, conduit hangers, anchors and steel supports necessary for the support and installation of all electrical equipment.

B. Where openings are required in walls and floors for the passing of raceways the Electrical Contractor shall furnish the General Contractor with the necessary information regarding dimensions and locations so that he may install suitable concrete stops to provide these openings. Such openings shall be by the General Contractor in such a manner so as to interfere with the fireproof integrity of the building.

C. The Electrical Contractor will be held responsible for the location of the maintaining in proper position, sleeves, inserts and anchor bolts supplied and/or set in place by him. In the event that failure to do so required cutting and patching of finished work, such work shall be done at the Electrical Contractor's expense by the General Contractor.

3.07 FIRE ALARM SYSTEM

A. The contractor is responsible for assuring that conduit and wire quantity, size and type are suitable for the equipment supplied. All final connections, testing, adjusting and calibration shall be made under the direct supervision of a trained specialist of the equipment manufacturer. System shall be tested to 100% performance before contacting the local Fire Department.

B. All system wiring shall be in type EMT conduit or an approval fire alarm control cable.

C. Upon completing and prior to all acceptance, an approved service company shall perform complete system tests in the presence of an authorized representative of the local Fire Department.

1. Actuate all manual and automatic indicating devices one at a time verify proper operation.

2. Verify operation of signaling systems, elevator capture, transmission or alarm to fire department, battery operation.

3. The contractor shall verify in writing that fire alarm system is operating properly.

3.08 FINAL INSPECTION AND TEST

A. Prior to test, feeders and branches shall be continuous from service contact point to each outlet include: all panels, feeders and devices. Test system free from short circuits and grounds with insulation resistances not less than outlines in the National Electrical Code. Provide testing equipment necessary and conduct test in presence of the Owner's representative.

B. Furnish all labor, material, instruments, supplies and services and bear all costs for the accomplishment of tests herein specified. Correct all defects appearing under test, repeat the tests until no defects are disclosed. Leave the equipment clean and ready for use.

C. The Electrical Contractor shall perform any test other than herein specified which may be specified by legal authorities or by agencies to whose requirements this work is to conform.

D. All equipment and material furnished by the Electrical Contractor shall operate under all conditions of load without objectionable noises or vibrations, which in the opinion of the Owner's Engineer, is objectionable. Where sound or vibration conditions arise which are considered objectionable by the Owner's Engineer, the Electrical Contractor shall eliminate it in a manner approved by the Owner's Engineer.

E. Final inspection and test report shall be provided for the following:

1. Testing of the emergency lighting system.
2. Testing of the impedance of the grounding system.
3. Testing of each outlet.
4. Testing of branch and feeder conductors for continuity.
5. Testing of panel boards to verify proper current balance and voltage.
6. Testing of motors, verifying proper current balance and voltage.
7. Testing, targeting and focusing of all adjustable lighting fixtures.
8. Ground fault coordination.
9. Fire alarm system.

3.09 BRANCH CIRCUITRY

A. For all lighting and appliance branch circuitry, raceway sizes shall conform to industry standard maximum permissible occupancy requirements except where these are exceeded by other requirements specified elsewhere.

B. Circuits shall be balanced on phases at their supply as evenly as possible.

C. Feeder connections shall be in the phase rotation which establishes proper operation for all equipment supplied.

D. Reduced size conductors indicated for any feeders shall be taken as their grounding conductors.

E. Feeders consisting of multiple cables and raceways shall be arranged such that each raceway of the feeder contains one cable for each leg and one neutral cable, if any.

F. For circuitry indicated as being protected at 20 Amps or less, abide by the following:

1. All 20 amp, 120/208 volt, 3 phase, 4 wire combined branch circuit homeruns shall be provided with an individual full neutral conductor.

2. All 20 amp branch circuit shall be provided with separate control.

3. Minimum conductor size shall be No. 12 AWG copper.

4. Conductors operating at 120 volts extending in excess of 100 feet, or at 277 volts extending in excess of 200 feet, or the last outlet or fixture tap shall be No. 10 AWG copper throughout.

5. Lighting fixtures and receptacles shall not be connected to the same circuit.

6. Circuits shall be balanced on phases at their supply point as evenly as possible.

7. Circuits for prewired modular furniture are based on an 8-wire system, 3 hots, 3 neutrals, 1 insulated ground and 1 isolated ground.

G. Type MC Cable Installation

1. Where cable is permitted under the products section, the installation of same shall be done in accordance with code and the following:

a. Cable shall be supported in accordance with code. Tie wire is not an acceptable means of support. Cable supports such as Caddy WMX-6, MX-3, and clamps such as Caddy 449 shall be used. Where cables are supported by the structure and only need securing in place, then ty-raps will be acceptable. Ty-raps are not acceptable as a means of support. All fittings, hangers, and clamps for support and termination of cables shall be of types specifically designed for use with cable, i.e., romex connectors not acceptable.
b. Armor of cable shall be removed with rotary cutter device equal to roto-split by Seatek co., not with hacksaw.
c. Use split "insuliner" sleeves at terminations.

3.10 REQUIREMENTS GOVERNING ELECTRICAL WORK IN DAMP OR WET LOCATIONS

A. Outlets and outlet size boxes shall be of galvanized cast ferrous metal only.

B. The finish of threaded steel conduit shall be galvanized only.

C. Wires for pulling into raceways for lighting and appliance branch circuitry shall be limited to "THWN".

D. Wires for pulling into raceways for feeders shall be limited to "THWN".

E. Plates for toggle switches and receptacles shall have gasketed snap shut covers suitable for wet locations while in use.

F. Final connections of flexible conduit shall be neoprene sheathed.

G. Apply one layer of half looped plastic electric insulating tape over wire nuts used for joining the conductors of wires.

H. Enclosures, junction boxes, pull boxes, cabinets, cabinet trims, wiring troughs and the like, shall be fabricated of galvanized sheet metal, shall conform to the following:

1. They shall be constructed with continuously welded joints and seams.

2. Their edges and weld spots shall be factory treated with cold galvanizing compound.

3. Their connection to circuitry shall be by means of watertight hub connectors with sealing rings.

I. Enclosures for individually mounted switching and overcurrent devices shall be NEMA Class IV weatherproof construction.

J. The covers, doors and plates and trims used in conjunction with all enclosures, pull boxes, outlet boxes, junction boxes, cabinets and the like shall be equipped with gaskets.

K. Panels shall be equipped with doors without exception.

L. The following shall be interpreted as damp or wet locations within building confines:

1. Spaces where any designations indicating weatherproof (WP) or vapor-proof appear on the drawings.

2. Below waterproofing in slabs applied directly on grade.

3. Spaces defined as wet or damp locations by article 100 of the National Electric Code.

3.11 REQUIREMENTS GOVERNING ELECTRIC WORK IN AIR HANDLING SPACES

A. Within air handling ductwork or plenums (other than spaces within suspended ceilings used for air handling purposes): Area B and the media shall comply with requirements for return air plenums.

1. Abide by the requirements specified for electric work in damp locations within

building confines.

2. Where circuitry passes through duct walls, include, in accordance with instructions issued in the field, airtight sealing provisions which allow for a relative movement between the circuitry and the duct walls.

3. Exclude the installation of type NM or NMC cable.

B. In spaces within suspended ceilings used for air handling purposes, abide by the requirements specified for normal electric work conditions except:

1. Lighting fixtures recessed into the ceilings shall be certified as being suitable for this purpose.

3.12 IDENTIFICATION AND TAGGING

A. Identify individually:

1. Each panelboard.
2. Each switch and circuit breaker.
3. Each feeder, wire or cable of all systems.
4. Each outlet.

B. Each wire or cable in a feeder shall be identified at its terminal points of connection and in each pullbox, junction box and panel gutter through which it passes.

C. The nomenclature used to identify panelboards or load center shall designate the numbers assigned to them.

D. The nomenclature used to identify switches or circuit breakers shall:

1. Where they disconnect mains or services designate this fact.

2. Where they control feeders, designate the feeder number and the name of the load supplied.

3. Where they control lighting and appliance branch circuitry, designate the name of the space and the load supplied.

E. The nomenclature used to identify feeder wires and cables shall designate the feeder number.

F. Identification for panelboards or load centers shall be by means of engraved lamacoid nameplates showing 1/4" high white lettering on a black background fastened to the outside face of the front.

G. Identification for switches or circuit breakers shall be by means of the following:

1. Where individually enclosed -- engraved lamacoid nameplates showing 1/8" high white lettering on a black background fastened on the outside front face of the enclosure.

2. Where in panelboards or load centers without doors -- same as for individually enclosed.

3. Where in panelboards or load centers with doors -- typewritten directories mounted behind transparent plastic covers, in metal frames fastened on the inside face of the doors.

H. Identification for wires and cables shall be by means of wrap around "brady" type labels.

I. Device plates for local toggle switches, toggle switch type motor starters, pilot lights and the like, whose function is not readily apparent shall be engraved with 1/8" high letters suitably describing the equipment controlled or indicated.

J. These identification letters shall be stamped into the metal of the bus bars of each phase of the main busses of each switchboard and each panelboard. The letters shall be visible from at least one "normal posture" location without having to demount any current carrying or supporting elements.

K. Identify each outlet box, junction box, and cabinet used in conjunction with empty raceway for wires of a future system by means of indelible markings on the inside denoting the system.

L. Prior to installing identifying tags and nameplates, submit their nomenclature for approval. Conform to all revisions issued by the Architect.

3.13 LIMITING NOISE PRODUCED BY ELECTRICAL INSTALLATION

A. Perform the following work, in accordance with field instructions issued by the Architect to assure that minimal noise is produced by electrical installations due to equipment furnished as part of the electrical work.

B. Check and tighten the fastenings of sheet metal plates, covers, doors and trims used in the enclosures of electrical equipment.

C. Remove and replace any individual device containing one or more magnetic flux path metallic cores (e.g., discharge lamp ballast, transformer, reactor, dimmer, solenoid) which is found to have a noise output exceeding that of other identical devices installed at the project.

3.14 SUPPORTS AND FASTENINGS

A. Support work in accordance with best industry standards and Mass. Electric Code.

B. Include supporting frames or racks for equipment, intended for vertical surface mounting, which is required in a free standing position.

C. Supporting frames or racks shall be of standard angle, standard channel or specialty support system steel members. They shall be rigidly bolted or welded together and adequately braced to form a substantial structure. Racks shall be of ample size to assure a workmanlike arrangement of all equipment mounted on them.

D. No work intended for exposed installation shall be mounted directly on any building surface. In such locations, flat bar members or spacers shall be used to create a minimum of 1/4" air space between the building surfaces and the work. Provide 3/4" thick exterior grade plywood painted with two coats of fire-retardant gray paint for mounting of panelboards.

E. Nothing (including outlet, pull and junction boxes and fittings) shall depend on electric conduits, raceways or cables for support.

F. Nothing shall rest on, or depend for support on, suspended ceiling media.

G. Support less than 2" trade size, vertically run, conduits at intervals no greater than 8 ft. Support such conduits, 2-1/2" trade size or larger, at intervals no greater than the story height, or 15 ft., whichever is smaller.

H. Where they are not embedded in concrete, support less than 1" trade size, horizontally run, conduits at intervals no greater than 7 ft. Support such conduits, 1" trade size or larger, at intervals no greater than 10 ft.

I. Support all lighting fixtures directly from structural slab, deck or framing member.

J. Where fixtures and ceilings are such as to require fixture support from ceiling openings frames, include in the electric work the members necessary to tie back the ceiling opening frames to ceiling suspension members or slabs so as to provide actual support for the fixtures noted above.

K. As a minimum procedure, in suspended ceilings support small runs of circuitry (e.g., conduit not in excess of 1 inch trade size) from ceiling suspension members as defined above. Support larger runs of circuitry directly from structural slabs, decks or framing members.

L. Fasten electric work to building structure in accordance with the best industry practice.

M. Floor mounted equipment shall not be held in place solely by its own dead weight. Include floor anchor fastenings in all cases.

N. For items which are shown as being ceiling mounted at locations where fastenings to the building construction element above is not possible, provide suitable auxiliary channel or angle iron bridging tying to building structural elements.

O. As a minimum procedure, where weight applied to the attachment points is 100 lbs. or less, fasten to concrete and solid masonry with bolts and expansion shields.

P. As a minimum procedure, where weight applied to building attachment points exceeds 100 lbs., but is 300 lbs. or less, conform to the following:

1. At field poured concrete slabs, utilize inserts with 20' minimum length slip-through steel rods, set transverse to reinforcing steel

3.15 SPLICING AND TERMINATING WIRES AND CABLES

A. Maintain all splices and joints in removable cover boxes or cabinets where they may be easily inspected.

B. Locate each completed conductor splice or joint in the outlet box, junction box, or pull box containing it, so that it is accessible from the removal cover side of the box.

C. Join solid conductors No. 8 AWG and smaller by securely twisting them together and soldering, or by using insulated coiled steel spring "wire nut" type connectors. Exclude "wire nuts" employing non-expandable springs. Terminate conductors No. 8 AWG and smaller by means of a neat and fast holding application of the conductors directly to the binding screws or terminals of the equipment or devices to be connected.

D. Join, tap and terminate stranded conductors No. 6 AWG and larger by means of solder sleeves, taps; and lugs with applied solder or by means of bolted saddle type or pressure indent type connectors, taps and lugs. Exclude connectors and lugs of the types which apply set screws directly to conductors. Where equipment or devices are equipped with set screw type terminals which are impossible to change, replace the factory supplied set screws with a type having a ball bearing tip. Apply pressure indent type connectors, taps and lugs utilizing tools manufactured specifically for the purpose and having features preventing their release until the full pressure has been exerted on the lug or connector.

E. Except where wire nuts are used, build up insulation over conductor joints to a value, equal both in thickness and dielectric strength, to that of the factory applied conductor insulation. Insulation of conductor taps and joints shall be by means of half-lapped layers of rubber tape, with an outer layer of friction tape; by means of half-lapped layers of approved plastic electric insulating tape; or by means of split insulating casings manufactured specifically to insulate the particular connector and conductor, and fastened with stainless steel or non-metallic snaps or clips.

F. Exclude splicing procedures for neutral conductors in lighting and appliance branch circuitry which utilize device terminals as the splicing points.

G. Exclude joints or terminations utilizing solder in any conductors used for grounding or bonding purposes.

H. Exclude all but solder or pressure indent type joints in conductors used for signaling or communications purposes.

I. Lugs for conductors used to make phase leg connections on the line side of the main service overcurrent and switching device shall be of the limiter type.

3.16 PULLING WIRES INTO CONDUITS AND RACEWAYS

A. Delay pulling wires or cables in until the project has progressed to a point when general construction procedures are not liable to injure wires and cables, and when moisture is excluded from raceways.

B. Utilize nylon snakes or metallic fish tapes with ball type heads to set up for pulling. In raceways 2" trade size and larger, utilize a pulling assembly ahead of wires consisting of

a suitable brush followed by an 3-1/2" diameter ball mandrel.

C. Leave sufficient slack on all runs of wire and cable to permit the secure connection of devices and equipment.

D. Include circular wedge-type cable supports for wires and cables at the top of any vertical raceway longer than 20 feet. Also include additional supports spaced at intervals which are no greater than 10'. Supports shall be located in accessible pull boxes. Supports shall be of a nondeteriorating insulating material manufactured specifically for the purpose.

E. Pulling lubricants shall be used. They shall be products manufactured specifically for the purpose.

F. Slack on wires and cables located in cabinets and pull boxes shall be formed and set in place in groupings corresponding to their occupancy of raceways. They shall also be arranged, with insulators and supports provided where necessary, such that cable shims or other such temporary expedients do not have to be left permanently in place to prevent the wires and cables from shifting when covers or trims are removed.

3.17 REQUIREMENTS FOR THE INSTALLATION OF JUNCTION BOXES, OUTLET BOXES AND PULL BOXES

A. Flush wall mounted outlet boxes shall not be set back to back but shall be offset at least 24" horizontally regardless of any indication on the drawings.

B. Locate all boxes so that their removable covers are accessible without necessitating the removal of parts of permanent building structure, including piping, ductwork, and other permanent mechanical elements.

C. In conjunction with concealed circuitry, abide by one of the following instructions (as may be applicable to the conditions) in order to assure the aforementioned accessibility. (Not required for circuitry concealed by removable suspended ceiling tiles.)

1. For a small (outlet size) box on circuitry concealed in a partition or wall, locate box or fitting so that its removable cover side (or the face of any applied raised cover) penetrates through to within 1/8" a of the exposed surface of the building materials concealing the circuitry and apply a blank or device plate to suit the functional requirements.

2. For a large box on circuitry concealed in a partition, suspended ceiling, or wall, locate box totally hidden but with its removable cover directly behind an architectural access door or panel (included for the purpose, separate from the electric work) in the building construction which conceals the circuitry.

3. For a small (outlet size) box on circuitry concealed above and intended as an outlet for a surface mounted lighting fixture or other such electrical item, locate box so that its removable cover side penetrates through to the exposed surface of the building materials concealing the circuitry. Arrange the mounting of the lighting fixture or other item so that it completely covers the opening in the building construction caused by the box.

4. For a small (outlet size) box on circuitry concealed in a suspended ceiling, and intended as an outlet for a non-demountable type of recessed lighting fixtures or other such electrical items, locate box totally hidden but with its removable cover not more than one foot away from the building construction opening occupied by the demountable items.

D. Apply junction and pull boxes in accordance with the following:

1. Include pull boxes in long straight runs of raceway to assure that cables are not damaged when they are pulled in.

2. Include junction and pull boxes to assure a neat and workmanlike installation of raceways.

3. Include junction and pull boxes to fulfill requirements pertaining to the limitations to the number of bends permitted in raceway between cable access points, the accessibility of cable joints and splices, and the application of cable supports.

4. Include all required junction and pull boxes regardless of indications on the drawings (which, due to symbolic methods of notation, may omit to show some of them).

E. Apply outlet boxes in accordance with the following:

1. Unless noted below or otherwise specifically indicated, include a separate outlet box for each individual wiring device, lighting fixture and signal or communication system outlet component. Outlet boxes supplied attached to lighting fixtures shall not be used as replacements for the boxes specified herein.

2. A continuous row of fixtures of the end-to-end channel type, designed for "through wiring," and wired in accordance with the specification hereinafter pertaining to circuitry through a series of lighting fixtures, may be supplied through a single outlet box.

3. A series of separate fixtures, designed for "through wiring," spaced not more than 4' apart, and inter- connected with conduit or raceway and circuitry which is in accordance with the specifications hereinafter pertaining to circuitry through a series of lighting fixtures, may be supplied through a single outlet box.

4. Connection to recessed ceiling fixtures supplied with pigtails may be arranged so that more than one, but not more than four, such fixtures are connected into a single outlet box. When adopting this procedure:

a. Utilize an outlet box no smaller than 5" square by 2-1/2" deep.

b. Allow no fixture to be supplied from an outlet box in another room.

5. Multiple local switches indicated at a single location shall be gang mounted in a single outlet box.

6. Include all required outlet boxes regardless of indications on the drawings (which due to symbolic methods of notation, may omit to show some of them).

F. Install junction boxes, pull boxes and outlet boxes in accordance with the following:

1. Exclude surface mounted outlet boxes in conjunction with concealed circuitry.

2. Exclude unused circuitry openings in junction and pull boxes. In larger boxes each such opening shall be closed with a galvanized sheet steel plate fastened with a continuous weld all around. In small outlet type boxes, utilize plugs as specified for such boxes.

3. Close up all unused circuitry openings in outlet boxes. Unused openings in cast boxes shall be closed with approved cast metal threaded plugs. Unused openings in sheet metal boxes shall be closed with sheet metal knock-out plugs.

4. Outlet boxes for switches shall be located at the strike side of doors. Indicated door swings are subject to field change. Outlet boxes shall be located on the basis of final door swing arrangements.

5. Boxes and plaster covers for duplex receptacles shall be arranged for vertical mounting of the receptacle.

6. Equip outlet boxes used for devices which are connected to wires of systems supplied by more than one set of voltage characteristics with barriers to separate the different systems.

G. Barriers in junction and pull boxes of outlet size shall be of the same metal as the box.

H. Barriers in junction and pull boxes which are larger than outlet size shall be of the polyester resin fiberglass of adequate thickness for mechanical strength, but in no case less than 1/4" thick. Each barrier shall be mounted, without fastenings, between angle iron guides so that they may be readily removed.

3.18 LOCATING AND ROUTING OF CIRCUITRY

A. In general, all circuitry shall be run concealed except that it shall be run exposed where the following conditions occur:

1. Horizontally at the ceiling of permanently unfinished spaces which are not assigned to mechanical or electrical equipment.

2. Horizontally and vertically in mechanical equipment spaces.

3. Horizontally and vertically in electric equipment rooms.

B. Concealed circuitry shall be so located that building construction materials can be applied over its thickest elements without being subject to spalling or cracking.

C. All circuitry and raceways shall not be run within slabs. If for field conditions requires raceways to be embedded in field poured structural building construction concrete fill or slab shall conform to the following:

1. All proposed embedded raceways shall be indicated on plan and elevation and submitted to the Architect and Structural Engineer for review and written approval prior to installation. Any costs associated with the review and approval shall be borned by the Electrical Subcontractor.

2. They shall be run "single layer" with their outside surface no closer than 1" to any surface of the structural concrete.

3. They shall not be located in any configuration which places the outside surface of one closer than 3" to the outside surface of another, except at tees, crosses or other single level wide angle junction points.

4. Where crossovers or close grouping are unavoidable, circuitry shall be carefully field coordinated so as not to cause structural weakness.

5. Where turned up or down into a wall or partition they shall, before entering same, be routed parallel for a long enough distance to assure that no relocation of the wall or partition will be necessary to conceal the required bend.

6. They shall be routed in such a manner as to coordinate with the structural requirements of the building.

7. They shall be routed in accordance with field instructions issued by the Architect where such instructions differ from specifications set forth herein.

D. Circuitry run exposed shall be routed parallel to building walls and column lines.

E. Exposed circuitry located overhead shall be run in a completely accessible manner on the underside of all piping and ductwork.

F. Circuitry run in suspended ceilings shall be routed parallel to building walls, column lines, etc.

G. Circuitry shall be routed so as to prevent electric conductors from being subject to high ambient temperature. Minimum clearances from heated lines or surfaces shall be maintained as follows:

1.	Crossing where uninsulated	3"
2.	Crossing where insulated	1"
3.	Running parallel where uninsulated	36"
4.	Running parallel where insulated	6"

H. Circuitry shall not be run in elevator shafts, hoistways, and the like. Where outlets for trail cables, pit lights, run be level lights, and the like, are involved, only the "final connection" outlet boxes themselves shall be located within or open into, the confines of the shaft.

I. Circuitry for miscellaneous systems indicated without notation as to location and routing shall be run as per the requirements and notations governing the adjacent light and power circuitry.

END OF SECTION

SECTION 27 0500

COMMON WORK RESULTS FOR COMMUNICATIONS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 0 & 1 Specification Sections, apply to this Section.

B. Related Work specified elsewhere includes, (but is not limited to):

1. Section 02 4119 – Selective Structure Demolition
2. Section 04 2000 – Unit Masonry
3. Section 07 8413 – Penetration Firestopping
4. Section 09 2000 – Plaster and Gypsum Board
5. Division 26 – Electrical
    a. The Electrical Contractor shall provide suitable raceway systems.
    b. The Electrical Contractor shall provide empty conduits with pull strings to accessible points above ceiling or below floor.
    c. The Electrical Contractor shall provide standard device boxes, with plaster rings, for Premise Structured Cabling System.
    d. All cutting and coring required for all the work of this Section shall be provided by the Electrical Subcontractor.
    e. The Electrical Sub-Contractor shall provide final connections of telecommunications grounding system to building grounding system.
6. The Owner shall provide active electronic equipment for voice and LAN and required connections to the like.
7. Section 27 0526 – Grounding and Bonding for Communications Systems
8. Section 27 0528 – Pathways for Communications Systems
9. Section 27 0553 – Identification for Communications Systems
10. Section 27 0800 – Commissioning of Communications
11. Section 27 1100 – Communications Equipment Room Fittings
12. Section 27 1323 – Communications Optical Fiber Backbone Cabling
13. Section 27 1500 – Communications Horizontal Cabling

C. The installation, operating cost and maintenance of the controlled environmental conditions, for equipment located on site, as required by the manufacturer, NFPA 70B, or as specified in these specifications shall be the responsibility of the General Contractor.

1.02 REFERENCES

A. Design, manufacture, test, and install telecommunications cabling networks per the manufacturer's requirements and in accordance with the latest revision of NFPA-70 (the National Electrical Code®), state codes, local codes, requirements of Authorities Having Jurisdiction (AHJ), and the following standards, including the most current revisions, addendums, and any Technical Service Bulletins (TSBs) released at the time of bid, including:

1. ANSI Z136.2, ANS For Safe Use of Optical Fiber Communication Systems Utilizing Laser Diode and LED Sources
2. ANSI/TIA-455-C, General Requirements for Standard Test Procedures for Optical Fibers, Cables, Transducers, Sensors, Connecting and Terminating Devices, and other Fiber Optic Components
3. TIA-526-7, Optical Power Loss Measurements of Installed Single-mode Fiber Cable Plant
4. TIA-526-14-B, Optical Power Loss Measurements of Installed Multimode Fiber Cable Plant; IEC 61280-4-1 edition 2, Fibre-Optic Communications Subsystem Test Procedure-Part 4-1: Installed cable plant- Multimode attenuation measurement

5. TIA-TSB-4979 Practical Considerations for Implementation of Multimode Launch Conditions in the Field
6. ANSI/TIA-1152, Requirements for Field Test Instruments and Measurements for Balanced Twisted-Pair Cabling
7. ANSI/TIA-568-0. D, Generic Telecommunications Cabling for Customer Premises.
8. ANSI/TIA-568-1. D, Commercial Building Telecommunications Cabling Standard
9. ANSI/TIA 568 C.2, Balanced Twisted-Pair Telecommunications Cabling and Components Standards.
10. ANSI/TIA 568 C.3, Optical Fiber Cabling Components Standard
11. ANSI/TIA-606-C, Administration Standard for Telecommunications Infrastructure, including the requirements specified by the customer, unless the customer specifies their own labeling requirements.
12. TIA-607 – Generic Telecommunications Bonding and Grounding (Earthing) for Customer Premises.
13. TIA/EIA-758 - B Customer-Owned Outside Plant Telecommunications Infrastructure.
14. TIA 942 Telecommunications Infrastructure Standard for Data Centers
15. TIA/TSB 140-2004; Additional Guidelines for Field-Testing Length, Loss and Polarity of Optical Fiber Cabling Systems
16. ISO/IEC 11801 A1: 2002 – Information Technology – Generic Cabling For Customer Premises
17. National Electrical Code
18. ANSI/NECA/BICSI-568 - Standard for Installing Commercial Building Telecommunications Cabling
19. BICSI - Telecommunications Distribution Methods Manual.
20. BICSI - Information Transport Systems Installation Manual.
21. BICSI - Network Design Reference Manual.
22. BICSI – Outside Plant Design Manual.

B. All standards related to or referenced by the standards listed herein.

1.03 DEFINITIONS

A. AWG – American Wire Gauge – The standardized wire gauge system for the diameter of round, solid, nonferrous, electrically-conducting wire.

B. BBC – Bonding Backbone Conductor – A telecommunication bonding connection which interconnects telecommunications bonding backbones. Formerly known as the grounding equalizer.

C. BD – Building Distributor – A distributor in which the building backbone cables terminate and at which connections to the campus backbone cables may be made.

D. BN – Bonding Network – A set of interconnected conductive structures that provides a low impedance path for the associated telecommunications infrastructure.

E. CP – Consolidation Point – A connection facility within Cabling Subsystem 1 for interconnection of cables extending from building pathways to the equipment outlet.

F. EDA – Equipment Distribution Area – A space allocated for end equipment, including computer systems and telecommunications equipment.

G. EF – Entrance Facility – An entrance to a building for both public and private network service cables, including wireless that includes the entrance point of the building and continues to the entrance room or space.

H. ER – Equipment Room – An environmentally-controlled, centralized space for telecommunications equipment that serves the occupants of the building, considered distinct from a Telecommunications Room (TR) because of the nature or complexity of the equipment.

I. ESD – Electro Static Discharge – The sudden flow of electricity between two electrically-charged objects caused by contact, an electrical short, or dielectric breakdown.

J. HC – Horizontal Cross-connect – A group of connectors, such as patch panels or punch-down blocks, that allow horizontal, backbone, and equipment cabling to be cross-connected with patch cords or jumpers.

K. HDA – Horizontal Distribution Area – A space in a computer room where a Horizontal Cross-connect (HC) is located, and which may include LAN switches, Storage Area Network (SAN) switches, and Keyboard/Video/Mouse (KVM) switches for the end equipment located in the Equipment Distribution Areas (EDAs).

L. IC – Intermediate Cross-connect – A facility enabling the termination of different levels of backbone cabling and interconnection between them or equipment.

M. MC – Main Cross-connect – A facility enabling the termination of backbone cables and their connection to incoming services, other backbone cabling, or equipment.

N. MDA – Main Distribution Area –The central point of distribution for the structured cabling system, which includes the Main Cross-connect (MC) and, when equipment areas are served directly from the MDA, may also include Horizontal Cross-connect (HC).

O. Mesh-BN – Mesh Bonding Network – A bonding network to which all associated equipment, such as cabinets, frames, racks, trays, and pathways, are connected using a bonding grid that is connected to multiple points on the common bonding network.

P. PBB – Primary Bonding Busbar – A busbar placed in a convenient and accessible location and bonded, by means of the Telecommunications Bonding Conductor (TBC), to the building's service equipment (power) ground. Formerly known as the Telecommunications Main Grounding Busbar (TMGB).

Q. RBB – Rack Bonding Busbar – A busbar within a cabinet, frame, or rack.

R. RBC – Rack Bonding Conductor – A bonding conductor from the rack or Rack Bonding Busbar (RBB) to the Telecommunications Equipment Bonding Conductor (TEBC).

S. RU – Rack Unit A unit of measure, compliant with EIA 310, used to describe the height of equipment intended for mounting on equipment rails. One RU is 1.75 inches (44.45 mm) high.

T. SBB – Secondary Bonding Busbar – A common point of connection for telecommunications system and equipment bonding to ground, located in the distributor room. Formerly known as the Telecommunications Grounding Busbar (TGB).

U. TBB – Telecommunications Bonding Backbone – The conductor that interconnects the Primary Bonding Busbar (PBB) to the Secondary Bonding Busbar (SBB).

V. TBC – Telecommunications Bonding Conductor – A conductor that interconnects the telecommunications bonding infrastructure to the building's service equipment (power) ground. Formerly known as the bonding conductor for telecommunications.

W. TEBC – Telecommunications Equipment Bonding Conductor – A conductor that connects the Primary Bonding Busbar (PBB) or Secondary Bonding Busbar (SBB) to equipment racks or cabinets.

X. TO – Telecommunications Outlet – A connecting device, located in a work area, at which the horizontal cabling terminates.

Y. TR – Telecommunications Room – An enclosed space for housing telecommunications equipment, cable terminations, and cross-connect cabling. It is the recognized location of the cross-connect between the backbone and horizontal facilities.

Z. UBC – Unit Bonding Conductor – A bonding conductor from equipment or a patch panel to a Rack Bonding Conductor (RBB) or a Rack Bonding Busbar (RBB).

AA. ZDA – Zone Distribution Area – A space where a zone outlet or consolidation point is located, between the horizontal and equipment distribution areas, that allows frequent reconfiguration and flexibility.

1.04 SUBMITTALS

A. General:

1. Refer to Divisions 0 & 1 in addition to requirements listed below.

B. Engineer's Review

1. The Engineer's review of shop drawings or samples shall not relieve the Contractor of responsibility for any deviation from the contract documents.
2. With the shop drawings, the Contractor shall include an index sheet detailing all deviations from the contract documents, and will be held responsible for all deviations, unless the Contractor has received written approval from the Engineer for the specific deviation, separate from general shop drawing approval.
3. The Engineer's review shall not relieve the Contractor from responsibility for errors or omissions in the shop drawings or samples.

C. General Component Data

1. For all products covered under this Section, the Contractor shall submit the following data for each component:

   a. A Specification Section
   b. The Manufacturer's name.
   c. The Manufacturer's model and part number

D. Copper Cable and Patch Cords

1. In addition to the general requirements above, the Contractor shall submit the following additional data:

   a. Cable identification numbers
   b. Cable specifications including quantity of pairs, material, insulation, performance, attenuation, Near-End CrossTalk (NEXT), diameter, conductor size, jacket, weight, and color
   c. The length of the patch cords
   d. The connector type for the patch cords

E. Fiber Cable and Patch Cords

1. In addition to the general requirements above, the Contractor shall submit the following additional data:

   a. Cable identification numbers
   b. Cable specifications including quantity of fibers, material, insulation, jacket, wavelength, attenuation, diameter, bend radius, core, cladding, coating, buffering, weight, and color
   c. The length of the patch cords
   d. The connector type for the patch cords

F. Devices

1. In addition to the general requirements above, the Contractor shall submit the following additional data for outlets, cover plates, and fiber connectors:

   a. The outlet specifications, including category rating, material, wiring, termination type, wire type, and color
   b. The associated faceplate
   c. A drawing of each device

G. Connecting Hardware

1. In addition to the general requirements above, the Contractor shall submit the equipment specifications for copper patch panels, fiber patch panels, and wiring blocks, including

quantity of ports, material, dimensions, mounting, terminating devices and color.

H. Connectors

1. In addition to the general requirements above, the Contractor shall submit the following additional data:

a. Connector specifications, including material, dimensions, attenuation, NEXT connection losses, ratings, and construction
b. A drawing of the equipment

I. Splicing and Terminations

1. In addition to the general requirements above, the Contractor shall submit the splicing and terminating tools, materials, and methods.

J. Testing

1. In addition to the general requirements above, the Contractor shall submit the following additional data:

a. The equipment serial number
b. A graphic diagram documenting the test procedure, including all connectors, the light source (as applicable,) the origin, and the destination of each cable tested.

K. Test Results

1. Refer to Section 27 0800: Commissioning of Communications
2. The Contractor shall submit all test results.

1.05 QUALITY ASSURANCE

A. Standards for Materials and Equipment

1. The Contractor shall provide all materials, equipment, and installation in compliance with the latest applicable standards from ANSI, FCC, ASTM, EIA/TIA, IEEE, NEC, NFPA, NEMA, OSHA, REA, and UL.
2. Electronic equipment provided by the Contractor shall have the UL label where applicable.

B. Installer Qualifications

1. Registered Communications Distribution Designer (RCDD)

a. The Contractor must have at least one (1) Registered Communications Distribution Designer (RCDD) as recognized by Building Industry Consulting Service International (BICSI.) The RCDD must be a full-time employee of the Contractor, and shall be responsible for compliance of work with the referenced standards and guidelines. At the time of bid, the RCDD shall provide a professional resume and proof of current registration to the Engineer for approval. The RCDD shall be present during construction and all cable testing and shall have:

1) Knowledge of BICSI installation standards
2) Knowledge of NEC standards
3) Knowledge of ANSI/TIA standards
4) Five (5) years of experience in the installation of optical fiber cables, including splicing, terminating, and testing including single and multimode.
5) Three (3) years of experience in the installation of balanced twisted pair copper cables for voice and data distribution systems, including splicing, terminating, testing, and complete verification of compliance with ANSI/TIA cable standards
6) Five (5) references for projects of equivalent scope, type, and complexity

of work completed within the last five (5) years. The Contractor shall submit, as proof, supporting documents and the names, addresses, and telephone numbers of the operating personnel who can be contacted regarding the installation of the system.

7) Certification by the termination equipment manufacturer as an installer

C. Other Installers

1. Products shall only be installed by qualified technicians certified by the manufacturers.

D. Provide all electronic equipment with the UL label when applicable.

E. Compliance with Laws, Ordinances, and Codes

1. As applicable, electronic equipment provided shall have the UL label.
2. Comply in every way with the requirements of local laws and ordinances, the National Board of Fire Underwriters, and the National Electrical Code. Anything in the plans or specifications that does not strictly comply with the above laws, ordinances, and rules must be referred to the attention of the Engineer for a decision before proceeding. No change in the plans or specifications shall be made without full consent, in writing, of the Engineer.

1.06 WARRANTY

A. Manufacturer's Warranty and Application Assurance

1. The Structured Connectivity Solutions Extended Manufacturer's Warranty and Application Assurance

a. The extended manufacturer's warranty, for a minimum of 25 years from the date of occupancy, shall include providing replacement or repair of defective product(s) and labor for the replacement or repair of such defective product(s) for the period indicated above.

b. Minimum twenty five (25) year application assurance: The application assurance shall cover the failure of the wiring system to support the application which it was designed to support, as well as additional application(s) introduced in the future for a minimum twenty five (25) year period.

c. System certification: Upon successful completion of the installation and subsequent inspection, the Owner shall be provided with a numbered certificate, from the manufacturer(s), registering the installation.

2. Extended Product Warranty

a. The Extended Product Warranty covers all passive Registered Manufacturer SCS components (i.e., cable and connectivity components that make up the passive data and telecommunications signal transmission infrastructure). "Passive Components" are defined as Manufacturer SCS components that exhibit no gain or contribute no energy. Manufacturer Solutions warrants, from the occupancy date, provided a registration certificate is issued by the Manufacturer Solutions to the customer, the following:

1) that the Passive Components of Registered Manufacturer SCS will be free from manufacturing defects in material and workmanship under normal and proper use;
2) that all Manufacturer Solutions Passive Components in the Registered Manufacturer SCS meet or exceed the relevant component specification of the TIA 568-C series and ISO/IEC 11801 standards;
3) that the Registered Manufacturer SCS compliant links/channels will meet or exceed the applicable requirements of the ANSI/TIA-568 series, and ISO/IEC 11801 standards for cabling links/channel configurations specified in these standards;
4) that the Registered Manufacturer SCS compliant channels will

additionally meet or exceed the Guaranteed Published Channel Performance in the Manufacturer SCS Performance Specifications Addendum in effect at the time of installation.

b. Under the Extended Product Warranty, Manufacturer Solutions will (or will authorize a Manufacturer Business Partner to) either repair or replace the defective Registered Manufacturer SCS product at Manufacturer Solution's cost. Manufacturer Solutions will pay a Manufacturer Business Partner for the cost of labor to repair or replace any such defective product on behalf of Manufacturer Solutions, provided, that such repair or replacement and associated labor costs receive the prior written approval of Manufacturer Solutions. If Manufacturer Solutions chooses to repair products, Manufacturer Solutions will use new replacement parts. If Manufacturer Solutions chooses to replace products, Manufacturer Solutions may replace such products with new products of the same or similar design. Any such repair or replacement will be warranted for either

1) 90 days or
2) The remainder of the original warranty period, whichever is longer.

3. Application Assurance

a. The Application Assurance covers the Registered Manufacturer SCS compliant to support operations of the application(s) that the system was designed to support, as well as additional application(s) defined below. Manufacturer Solutions warrants that the Registered Manufacturer SCS will be free from defects that prevent operation of the specific application(s) for which the Registered Manufacturer SCS was initially designed as long as the design is in compliance with the Manufacturer SCS Performance Specifications for said applications and is in compliance with all other terms and conditions of this warranty.

b. The Application Assurance also covers the following additional applications:

1) those as specified in the current (at the time of installation) Manufacturer SCS Performance Specifications and Addendums; and
2) in accordance with application standards specifications, any application introduced in the future by recognized standards or user forums that use the relevant TIA-568 series or ISO/IEC 11801 components and link/channel specifications for cabling, to the extent that such applications are defined to operate over the guaranteed channel performance and/or the installed channel topologies.

4. Term of Warranty

a. The warranty period will be for a minimum of Twenty Five (25) years from the date of occupancy.
b. Moves, additions, or changes are covered by the original registration certificate if performed by a Manufacturer Business Partner in compliance with the Manufacturer SCS design, installation and registration requirements.
c. Administration of Manufacturer SCS cords by the end user is covered by the original registration certificate.

5. Person / Entity Covered

a. This warranty is for the sole benefit of the person or entity to whom the Manufacturer Solution's registration certificate is issued and any successor in interest to the site in which such Registered Manufacturer SCS was originally installed.

B. Testing and Inspection of Communications Equipment

1. Provide tests specified below, when applicable, and as indicated under individual items of material, equipment, and work specified in this Specification.

    a. Furnish all test equipment and instruments required for the tests.
    b. Responsible, qualified employees of the contractor in the presence of the Owner or an authorized representative shall perform the cable testing.
    c. All individuals involved in the testing phase of the project shall not have been involved in the installation phase nor shall have immediate knowledge of the installation task.

2. End to end performance of all parts and channels will be tested.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Handling

1. To prevent damage, theft, soiling, and misalignment, protect equipment during transit, storage, and handling.

B. Storage

1. The contractor shall coordinate the secure storage of equipment and materials on site, or, if no on-site storage is available, shall provide their own secure storage at the Contractor’s expense.

    a. Do not store equipment where conditions fall outside the manufacturer's recommendations for environmental conditions.
    b. Do not install damaged equipment. Remove environmental conditions from the site, and replace damaged equipment with new equipment.
    c. If off-site storage of materials is necessary, this shall be at the Contractor’s expense.

1.08 COORDINATION

A. Installation Schedule

1. The Contractor shall coordinate with all other trades. The Contractor will submit a schedule for the installation within 10 days of contract award.

    a. The schedule shall include delivery, installation, and testing for conformance to specific job completion dates.
    b. At minimum, the schedule shall provide dates for the start of demolition, the completion of demolition, the installation start date, the completion of copper cabling, the completion of backbone cabling, the completion of testing and labeling, cutover, the completion of the final punch list, final inspection, and acceptance.

B. Meeting Attendance and Schedule Adherence

1. The Contractor must attend all project-related meetings and adhere to schedule set by the Project Manager.

C. Final Inspection

1. The Contractor is required to notify the Engineer of a proposed appointment for Final Inspection at least 72 hours before the appointment.
2. Within five working days after the final inspection, the Contractor shall send final project documentation and warranty information to the Owner and Engineer. The final project documentation shall include, but may not be limited to:

    a. As-Built Drawings, in an AutoCAD format, with legible outlet address and cable paths
    b. Outlet location spreadsheets
    c. Warranty paperwork

d. A copy of the Final Inspection and Acceptance Signoff Sheet
e. Photos of each ER and TR

1.09 PERMITS, FEES, RULES AND REGULATIONS

A. Give the proper Authorities all requisite notices or information relating to the work under this Section. Obtain and pay for all fees, licenses, permits and certificates. Comply with the rules and regulations of all Local, State and Federal Authorities having jurisdiction, Building Codes, the rules and regulations of the National Board of Fire Underwriters and the Public Utility Companies serving the building.

B. Public utility back charges will be paid for by the Owner and are not to be included in the base bid. Markups on utility back charges will not be allowed.

C. Perform work in accordance with Nationally Recognized Testing Laboratory (NRTL) listing or labeling requirements, OSHA regulations, NFPA Standards, Electrical Code, and The Americans with Disabilities Act Accessibility Guidelines (ADAAG), EIA/TIA and BICSI. The Drawings and Specifications do not attempt to indicate all work required by codes, regulations and authorities.

D. Nothing in these Contract Documents shall be construed to permit work not conforming to applicable codes and regulations. When conflicts occur the more restrictive requirements shall govern.

E. Toxicity: Comply with applicable codes and regulations regarding toxicity of combustible products or materials used or hazardous materials used.

F. Legally dispose of all material. Adhere to all regulations regarding disposal of hazardous material. Recycle hazardous material where recycling is possible. Submit certificates of legal recycling or disposal to the Architect. Include copy in the Owner and Maintenance Manual.

G. Should the Facility have established building standards, rules or regulations, obtain a copy from the Building Owner and comply with them.

1.10 PROJECT CONDITIONS

A. Project Environmental Requirements

1. Seismic Safety

a. Provide mechanical and electrical support for all installed equipment as required by all applicable local building codes for this installation’s earthquake risk hazard zone and as recommended by Telcordia Specification GR-63.
b. Anchor all equipment racks with suitable anchors that meet safety standards.
c. Mount overhead devices with appropriate safety attachments as required.
d. Where cabinets and racks are secured directly to the building, this shall be done in accordance with guidance provided by the Authority Having Jurisdiction (AHJ) or a structural engineer.
e. Provide shock and vibration isolation of equipment and fixtures as required.

2. Fiber Optic Cable Safety

a. The following warnings shall be posted on the job site:

1) WARNING: PERMANENT EYE DAMAGE CAN RESULT FROM LOOKING DIRECTLY INTO A LIGHT BEAM GENERATED BY AN LED OR LASER SOURCE OR INTO THE END OF A CABLE FIBER CONNECTED TO ONE OR THESE SOURCES.
2) CAUTION: LIGHT GENERATED BY THESE SOURCES MAY NOT BE VISIBLE, YET REMAIN HAZARDOUS TO THE EYE. LOOK FOR WARNING LABELS ON SOURCE DEVICES.

b. Observe all warning signs on equipment and all written safety precautions in the instruction and technical manuals.

c. Always handle cable carefully to avoid personal injury. Care should be taken with individual fibers to prevent injury to the eyes or penetration of the fibers into the skin.

3. Hazardous Materials Prohibition

a. The Contractor shall ensure that all materials used in the project are asbestos-free, unless specifically authorized in writing by the Owner.

4. Existing Conditions

a. Verify that all conditions on the project site are acceptable for the Work specified in this Section. Prior to bid opening, notify the Consulting Engineer, in writing, of any discrepancies, conflicts, or omissions. Otherwise, correct these issues at no additional cost to the Owner.

b. Continue to monitor the project site. If conditions develop that require a variance from the Specifications or Drawings, then immediately notify the Owner in writing. Otherwise, make recommendations, submit drawings showing how the Work may be installed, and, upon approval, proceed with the necessary changes without additional cost to the Owner.

B. Record Drawings

1. Keep a complete set of all telecommunications drawings in the job site office for demonstration of the actual installation work specified in this Section.
2. Use this set of drawings for no other purpose.
3. Where any material, equipment, or system components are installed differently than what is shown on the drawings, indicate the differences clearly and neatly using ink or indelible pencil.
4. Upon completion of the project, submit the record set of drawings.

1.11 USE OF THE SITE

A. Where the Owner deems it necessary to place restrictions, use the site as directed by the Owner.

B. When proceeding with the work, do not interfere with the ordinary use of streets, aisles, passages, exits, or operations of the Owner. During the day, set up cones and barriers in hallways and walkways. Do not string cable down the hallways during normal hours.

C. Request a hazardous materials worksheet that identifies potentially-hazardous locations. Do not proceed with any work in locations where hazardous materials are known to be. Obtain instructions from the Contractor’s Project Manager on and when to work in these areas.

D. Multiple times each day, each contractor shall remove all trash and debris from the site. Before leaving the room each day:

1. The Contractor shall replace all ceiling tiles that they have removed.
2. The Contractor shall place all furniture and equipment that they have moved back into its original location.
3. The Contractor shall return any equipment that they have disconnected to working order.
4. The Contractor’s Job Foreman shall inspect all work locations to ensure that the rooms are clean and that all of the tasks described above have been done.
5. It is recommended that the Contractor inspect the site and take pictures to document the condition of the ceilings and walls.

1.12 CONTINUITY OF SERVICES

A. Take no action that will interfere with or interrupt existing building services, unless previous arrangements have been made with the Owner's representative. Arrange all work to minimize shutdown time.

B. The Owner's personnel shall perform shutdown of operating systems. When shutdown of

systems is required, the Contractor shall give three (3) days advance notice.

C. Should building services be inadvertently interrupted:

1. The Job Foreman shall immediately notify the Project Manager of the accidental disruption of services, the remedy, and how long it will take to restore services.
2. The Contractor shall immediately furnish the labor, including overtime, the material, and the equipment necessary to promptly restore the interrupted service at no cost to the Owner.

1.13 OWNER INSTRUCTION

A. At the time of substantial completion, the Contractor shall submit the System Operation Manual and the Maintenance Data Manual, each neatly bound, with tabbed dividers between sections, and a title page with space for submittal stamps.

B. Maintenance Data Manual

1. The Maintenance Data Manual shall include:

a. A Table of Contents
b. The company name, address, telephone number, and contact name for system service or maintenance
c. A list of all equipment and materials, with the names of the manufacturers and the model numbers or part numbers
d. Catalog data sheets that include the manufacturers' names, addresses, and telephone numbers
e. Product manufacturers' warranties and a typed one-year system warranty that explicitly covers all materials and labor
f. The manufacturers' service manuals for all major equipment items
g. Test documentation showing the results of source quality control tests, field quality control tests, acceptance testing, and certification
h. A recommended preventative maintenance schedule with:

1) References to the applicable pages in the manufacturer's maintenance manuals
2) Where inadequate information is provided by the manufacturer, the information necessary for proper maintenance

C. Electronic Submittal

1. In addition to hard copy submittals, the Contractor shall submit all files needed to produce the above submittals:

a. Transportation media shall be in Microsoft® structure on CD-ROM or USB flash drive
b. A Master File List, in text format, placed on each medium, with a short description of files in the submittal
c. Drawings, in AutoCAD R2010 or later drawing format (.DWG), that include all XREFs, fonts, and other drawing parts required for the drawings

1) **Note:** Drawing Exchange File Format (.DXF) is not acceptable

d. Word processing files in MS Word 2007 format
e. Graphs and charts in MS Excel 2007 format
f. All graphic images required for the reproduction of the submittals included in the files in JPEG (.JPG) file format
g. Manufacturers' data sheets, equipment manuals, and other documentation provided by the Manufacturers to the Contractor or documents that are similarly not otherwise available to the Contractor in electronic format shall be excluded from this requirement.

D. Keys

1. Submit three copies of all keys required for access to and operation of the systems.

1.14 COMMISSIONING

A. Furnish one initial set of product brochures and owner's manuals to the Owner for use during acceptance testing and equalization.

B. Refer to Section 27 0800 – "Commissioning of Communications"

1.15 LABELING

A. Comply with TIA-606-C and UL 969 for a system of labeling materials, including label stocks, laminating adhesives, and inks used by label printers.

B. Refer to Section 27 0553 – "Identification for Communications Systems"

PART 2 - PRODUCTS

2.01 GENERAL

A. This Section includes General Requirements for each section in Division 27 and shall be used in conjunction with specifications, other related Divisions and related Contract Documents to establish the total requirements for the project:

1. Refer to specific sections for Products.

B. All products must be from same manufacturer

PART 3 - EXECUTION

3.01 WORKMANSHIP

A. Manufactured products, materials, equipment, and components shall be provided, conditioned, applied, installed, connected, and tested in accordance with the manufacturer's specifications and printed instructions.

B. The installation of all system components shall be carried out under the direction of qualified personnel. Appearance shall be considered as important as mechanical and electrical efficiency. Workmanship shall meet or exceed industry standards.

3.02 INTENT OF DRAWINGS:

A. The technology drawings show only general locations of equipment, devices, raceways, cable trays, boxes, etc., unless specifically dimensioned.

B. The contractor shall be responsible for the proper placement and routing of equipment, cable, raceways, cable runway, and related components, according to the Contract Documents and subject to prior review by the Owner and structured cabling engineer.

C. The contractor shall refer any conflicts within the Contract Documents to the Construction Manager and/or Owner for resolution.

3.03 GROUNDING

A. Comply with requirements in Section 26 0526 "Grounding and Bonding for Communications Systems." for grounding conductors and connectors.

B. Comply with ANSI/TIA-607-C-1 and the National Electrical Code.

3.04 FIRESTOPPING

A. Comply with requirements in the National Building Code and the National Electrical Code,

B. Comply with Section 07 8413 "Penetration Firestopping".

3.05 LAYOUT AND TOLERANCES

A. Follow as closely as practicable the schematic design shown on the drawings. Make all necessary measurements in the field to verify exact locations and ensure precise location and fit of specified items in accordance with the drawings. Make no substantial alterations without prior approval of the Owner and the Engineer.

3.06 FINAL TEST AND ADJUST

A. The contractor shall be responsible for post-installation performance testing of all cabling systems specified elsewhere in this Section of the Contract Documents:

1. Testing procedures shall permit recording the length of each link, theoretical loss budget, and tested parameters for each pair and fiber, including space for sign-off by CM and Owner.
2. Any cable links or fiber strands, which fail to meet performance test criteria, shall be reterminated, reconnectorized, or replaced by the contractor free of charge.
3. Submit final field test documentation in list form, including the CM signature for Owner's approval.

3.07 CONSTRUCTION REVIEW

A. The Engineer and Owner will review and observe installation work to ensure compliance by the contractor with requirements of the Contract Documents.

B. The contractor shall inspect and test completed communications installations to demonstrate specified performance levels including the following:

1. Furnish all instruments and personnel required for the inspections and tests.
2. Perform tests in the presence of the Engineer and Owner.
3. Demonstrate that the system components operate in accordance with the Contract Documents.

C. Review, observation, assistance, and actions by the Engineer and Owner shall not be construed as undertaking supervisory control of the work or of methods and means employed by the contractor. The Engineer and Owner review and observation activities shall not relieve the contractor from the responsibilities of these Contract Documents.

D. The fact that the Engineer and Owner does not make early discovery of faulty or omitted work shall not bar the Owner from subsequently rejecting this work and withholding payment until the contractor makes the necessary corrections.

E. Regardless of when discovery and rejection are made, and regardless of when the contractor is ordered to correct such work, the contractor shall have no claim against the Engineer or Owner for an increase in the Subcontract price, or for any payment on account of increased cost, damage, or loss.

3.08 PROJECT RECORD DOCUMENTS

A. Provide detailed project record documentation for sections listed in paragraph 1.1 above, in addition to the standard requirements, within 30 days after completion of the work.

B. Maintain separate sets of redlined record drawings for the communications work, which show the exact placement, and identification of as-built system components. These are subject to weekly review by the CM, Owner, or its representative.

C. Provide communication room record drawings which indicate exact placement for all components; e.g., conduit, wireway, cable tray, backboards, equipment cabinets, equipment racks, and cross-connect equipment, etc.

D. Provide communication wiring and cabling record drawings and schedules which indicate exact placement, routing, and connection details for all components, e.g., twisted-pair cables, splices, cable cross-connect termination locations, enclosures, telecommunications outlets, and cross-connect jumpers, patch cords, etc.

E. Provide network schematics when appropriate.

F. Cable Schedule: Install in a prominent location in each equipment room and wiring closet. List incoming and outgoing cables and their designations, origins, and destinations. Protect with rigid frame and clear plastic cover. Furnish an electronic copy of final comprehensive schedules for Project.

G. Cabling Administration Drawings: Show building floor plans with cabling administration-point labeling. Identify labeling convention and show labels for telecommunication spaces, backbone pathways and cables, entrance pathways and cables.

3.09 DEFINITION OF ACCEPTANCE

A. System acceptance shall be defined as that point in time when the following requirements have been fulfilled:

1. All submittals and documentation have been submitted, reviewed, and approved.
2. The complete system has successfully completed all testing requirements.

B. All punch list items have been corrected and accepted.

END OF SECTION

SECTION 27 0526

GROUNDING AND BONDING FOR COMMUNICATIONS SYSTEMS

PART 1 GENERAL

1.01 SUMMARY

A. This Section includes the specifications for:

1. The supply, delivery, supervision, coordination, and installation of equipment items specified herein and shown on drawings
2. The specifications for the incorporation of Owner Furnished Equipment (OFE)
3. The testing, documentation and instructions for completing the Grounding and Bonding for Communications Systems
4. Products supplied but not installed under this section, including:

    a. Loose equipment, specified herein, which is to be turned over to the owner at the completion of this project
    b. Bonding busbars, specified herein, to be turned over to the Electrical Contractor for installation

B. Owner Furnished Equipment (OFE)

1. Certain equipment may be identified as Owner Furnished Equipment (OFE). This OFE may presently be part of the Owner's system, or may be provided by the Owner and will either be delivered to Contractor's off-site construction facility, be delivered to the Contractor's on-site secured storage area, or be installed on site by others, as appropriate, for incorporation into the system.

    a. Clean and inspect all OFE.
    b. Notify the Owner in writing of damage, defects, and the extent of any repair or adjustment required for the OFE to meet the original specification.
    c. Service OFE only as directed by the Owner under the arrangements of a separate contract, and incorporate repaired or adjusted OFE into the system as if it were provided new, except for warranty coverage.

C. Related Drawings

1. T-Series drawings follow the specifications in this Section.
2. Electrical drawings specify the electrical requirements.
3. Interior Design drawings specify the interior finishes, spatial relationships between items, and specific mounting heights.

D. What the Contractor Shall Provide and Install

1. Although such work is not specifically mentioned herein or on the drawings, the Contractor shall furnish and install all miscellaneous items, accessories, appurtenances, and devices incidental to or necessary for a sound, secure, and complete installation, without claim for additional payment.
2. The Contractor shall provide system testing and demonstration, system documentation, and instruction of Owner personnel, without claim for additional payment.

E. Errors or Omissions in Drawings or Documentation

1. If any errors or omissions appear in Drawings, Specifications, or other documents, the bidding Contractor shall notify the Engineer no later than ten (10) days prior to submitting the bid.
2. Should conflict occur in or between drawings and specifications, the bidding Contractor

is deemed to have estimated the more expensive way of doing the work, unless the bidding Contractor has asked for and obtained a written decision (addendum), before the submission of the bid, as to which method or materials will be required.

F. Dimensions

1. The dimensions indicated are limiting dimensions.

a. Do not use equipment exceeding the dimensions indicated.
b. Do not use equipment or arrangements that reduce the required clearances or exceed the specified maximum dimensions.

1.02 REFERENCES

A. Requirements, Codes, and Standards

1. Design, manufacture, test, and install telecommunications cabling networks per the manufacturer's requirements and in accordance with the latest revision of NFPA-70 (the National Electrical Code®), state codes, local codes, requirements of Authorities Having Jurisdiction (AHJ), and the following standards, including the most current revisions, addendums, and any Technical Service Bulletins (TSBs) released at the time of bid, including:

a. TIA-607 – Generic Telecommunications Bonding and Grounding (Earthing) for Customer Premises
b. IEEE C2-2012, National Electrical Safety Code® (NESC®)
c. IEEE 1100-2005, Recommended Practice for Powering and Grounding Electronic Equipment
d. NFPA – National Electrical Code® (NEC®)

B. BICSI® Publications

1. Install cabling in accordance with the most recent edition of the following BICSI® publications:

a. BICSI – Telecommunications Distribution Methods Manual, Current Edition
b. BICSI – Information Technology Systems Installation Manual, Current Edition
c. BICSI – Outside Plant Design Reference Manual, Current Edition

C. Applicability of Codes, Rules, and Regulations

1. Federal, state, and local codes, rules, regulations, and ordinances governing the work are as fully part of the specifications as if herein repeated or hereto attached.
2. If the Contractor notes items in the drawings or the specifications, construction of which would be code violations, the Contractor should promptly call them to the attention of the Owner's representative in writing.
3. Where the requirements of other Sections of the specifications are more stringent than the applicable codes, rules, regulations, and ordinances, the specifications shall apply.

D. Manufacturers' Recommendations

1. To maintain the applications warranties, install all cabling and termination devices using the manufacturers' recommended installation practices.

E. Definitions

1. The following are the definitions of the terms used in this Section:

a. AWG – American Wire Gauge – The standardized system for gauging the diameter of round, solid, non-ferrous, electrically-conducting wire.
b. BBC – Bonding Backbone Conductor – A telecommunication bonding connection

which interconnects telecommunications bonding backbones. Formerly known as the grounding equalizer.

c. BD – Building Distributor – A distributor in which the building backbone cables terminate and at which connections to the campus backbone cables may be made.
d. BN – Bonding Network – A set of interconnected conductive structures that provides a low impedance path for the associated telecommunications infrastructure.
e. CP – Consolidation Point – A connection facility within Cabling Subsystem 1 for interconnection of cables extending from building pathways to the equipment outlet.
f. EDA – Equipment Distribution Area – A space allocated for end equipment, including computer systems and telecommunications equipment.
g. EF – Entrance Facility – An entrance to a building for both public and private network service cables, including wireless that includes the entrance point of the building and continues to the entrance room or space.
h. ER – Equipment Room – An environmentally-controlled, centralized space for telecommunications equipment that serves the occupants of the building, distinct from a Telecommunications Room (TR) because of the nature or complexity of the equipment.
i. ESD – Electro Static Discharge – The sudden flow of electricity between two electrically-charged objects caused by contact, an electrical short, or dielectric breakdown.
j. HC – Horizontal Cross-connect – A group of connectors, such as patch panels or punch-down blocks, that allow horizontal, backbone, and equipment cabling to be cross-connected with patch cords or jumpers.
k. HDA – Horizontal Distribution Area – A space in a computer room where a Horizontal Cross-connect (HC) is located and which may include LAN switches, Storage Area Network (SAN) switches, and Keyboard/Video/Mouse (KVM) switches for the end equipment located in the equipment distribution areas.
l. IC – Intermediate Cross-connect – A facility enabling the termination of different levels of backbone cabling and interconnection between them or equipment.
m. MC – Main Cross-connect – A facility enabling the termination of backbone cables and their connection to incoming services, other backbone cabling, or equipment.
n. MDA – Main Distribution Area – The central point of distribution for the structured cabling system, which includes the Main Cross-connect (MC) and, when equipment areas are served directly from the MDA, may also include Horizontal Cross-connect (HC).
o. Mesh-BN – Mesh Bonding Network – A bonding network to which all associated equipment, such as cabinets, frames, racks, trays, and pathways, are connected using a bonding grid that is connected to multiple points on the common bonding network.
p. PBB – Primary Bonding Busbar – A busbar placed in a convenient and accessible location and bonded, by means of the Telecommunications Bonding Conductor (TBC), to the building's service equipment (power) ground. Formerly known as the Telecommunications Main Grounding Busbar (TMGB).
q. RBB – Rack Bonding Busbar – A busbar within a cabinet, frame, or rack.
r. RBC – Rack Bonding Conductor – A bonding conductor from the rack or Rack Bonding Busbar (RBB) to the Telecommunications Equipment Bonding Conductor (TEBC).
s. RU – Rack Unit – A unit of measure, compliant with EIA 310, used to describe the height of equipment intended for mounting on equipment rails. One RU is 1.75 inches (44.45 mm) high.
t. SBB – Secondary Bonding Busbar – A common point of connection for telecommunications system and equipment bonding to ground, located in the distributor room. Formerly known as the Telecommunications Grounding Busbar (TGB).

u. TBB – Telecommunications Bonding Backbone – The conductor that interconnects the Primary Bonding Busbar (PBB) to the Secondary Bonding Busbar (SBB).
v. TBC – Telecommunications Bonding Conductor – A conductor that interconnects the telecommunications bonding infrastructure to the building's service equipment (power) ground. Formerly known as the bonding conductor for telecommunications.
w. TEBC – Telecommunications Equipment Bonding Conductor – A conductor that connects the Primary Bonding Busbar (PBB) or Secondary Bonding Busbar (SBB) to equipment racks or cabinets.
x. TO – Telecommunications Outlet – A connecting device, located in a work area, at which the horizontal cabling terminates.
y. TR – Telecommunications Room – An enclosed space for housing telecommunications equipment, cable terminations, and cross-connect cabling. It is the recognized location of the cross-connect between the backbone and horizontal facilities.
z. UBC – Unit Bonding Conductor – A bonding conductor from equipment or a patch panel to a Rack Bonding Conductor (RBB) or a Rack Bonding Busbar (RBB).
aa. ZDA – Zone Distribution Area – A space where a zone outlet or consolidation point is located, between the horizontal and equipment distribution areas, that allows frequent reconfiguration and flexibility.

1.03 PERMITS, FEES, AND CERTIFICATES OF APPROVAL

A. If required, the Owner or Owner's authorized agent will make application for and pay for any building permits.

1.04 SUBMITTALS

A. Engineer's Review

1. The Engineer's review of shop drawings or samples shall not relieve the Contractor of responsibility for any deviation from the contract documents.
2. The Contractor shall include, with the shop drawings, an index sheet detailing all deviations from the contract documents and will be held responsible for all deviations, unless the Contractor has received written approval from the Engineer for the specific deviation, separate from general shop drawing approval.
3. The Engineer's review shall not relieve the Contractor from responsibility for errors or omissions in the shop drawings or samples.

B. For all products, the Contractor shall submit the following data for each component covered under this Section:

1. A Specification Section reference
2. The Manufacturer's name
3. The Manufacturer's model number and part number

1.05 QUALITY ASSURANCE

A. Standards for Materials and Equipment

1. The Contractor shall provide all materials and equipment, and shall install them in compliance with the latest applicable standards from ANSI, FCC, ASTM, EIA/TIA, IEEE, NEC, NFPA, NEMA, OSHA, REA, and UL.
2. The Contractor shall provide all electronic equipment with the UL label when applicable.

B. Installer Qualifications

1. Registered Communications Distribution Designer (RCDD)

a. The Contractor must have at least one (1) Registered Communications Distribution Designer (RCDD) as recognized by Building Industry Consulting Service International (BICSI). The RCDD must be a full-time employee of the Contractor, and shall be responsible for the compliance of work with the referenced standards and guidelines. At the time of bid, the RCDD shall provide a professional resume and proof of current registration to the Engineer for approval. The RCDD shall be present during construction and all cable testing and shall have:

1) Knowledge of BICSI installation standards
2) Knowledge of NEC standards
3) Knowledge of ANSI/TIA standards
4) Five (5) years of experience in the installation of optical fiber cables, including splicing, terminating, and testing, including single-mode and multi-mode
5) Three (3) years of experience in the installation of Balanced Twisted Pair (BTP) copper cables for voice and data distribution systems, including splicing, terminating, testing, and complete verification of compliance with ANSI/TIA cable standards
6) Five (5) references for projects of equivalent scope, type, and complexity with work completed within the last five (5) years – The Contractor shall submit, as proof, supporting documents and the names, addresses, and telephone numbers of the operating personnel who can be contacted regarding the installation system.
7) Certification by the termination equipment manufacturer as an installer

2. Other Installers

a. Products shall only be installed by qualified technicians certified by the manufacturers.

C. Compliance with Laws, Ordinances, and Codes

1. Comply in every way with the requirements of local laws and ordinances, the National Board of Fire Underwriters, and the National Electrical Code. Anything in the plans or specifications that does not strictly comply with the above laws, ordinances, and rules must be referred to the attention of the Engineer for a decision before proceeding. No change in the plans or specifications shall be made without full consent, in writing, of the Engineer.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Handling

1. To prevent damage, theft, soiling, and misalignment, protect equipment during transit, storage, and handling.

B. Storage

1. The Contractor shall coordinate the secure storage of equipment and materials on site or, if no on-site storage is available, shall provide their own secure storage at the Contractor’s expense.

a. Do not store equipment where conditions fall outside manufacturer's recommendations for environmental conditions.
b. Do not install damaged equipment. Remove damaged equipment from the site, and replace it with new equipment.
c. If off-site storage of materials is necessary, this shall be at the Contractor’s expense.

1.07 COORDINATION

A. Installation Schedule

1. The Contractor shall coordinate with all other trades. The Contractor will submit a schedule for the installation within 10 days of contract award.

    a. The schedule shall include delivery, installation, and testing for conformance to specific job completion dates.
    b. At minimum, the schedule shall provide dates for the start of demolition, the completion of demolition, the installation start date, the completion of horizontal cabling, the completion of backbone cabling, the completion of testing and labeling, cutover, the completion of the final punch list, final inspection, and acceptance.

B. Meeting Attendance and Schedule Adherence

1. The Contractor must attend all project-related meetings and adhere to the schedule set by the Project Manager.

C. Final Inspection

1. The Contractor is required to notify the Engineer of a proposed appointment for Final Inspection at least 72 hours before the appointment.
2. Within five working days after the final inspection, the Contractor shall send final project documentation and warranty information to the Owner and Engineer. The final project documentation shall include, but may not be limited to:

    a. As-Built Drawings, in AutoCAD format, with legible outlet addresses and cable paths
    b. Outlet location spreadsheets
    c. Warranty paperwork
    d. A copy of the Final Inspection and Acceptance Signoff Sheet
    e. Photos of each ER and TR

1.08 PROJECT CONDITIONS

A. Project Environmental Requirements

1. Seismic Safety

    a. Provide mechanical and electrical support for all installed equipment as required by all applicable local building codes for this installation's earthquake risk hazard zone and as recommended by Telcordia Specification GR-63.
    b. Where cabinets and racks are secured directly to the building it will need to be done so in accordance with guidance provided by the Authority Having Jurisdiction (AHJ) or a structural engineer.
    c. Provide shock and vibration isolation of equipment and fixtures as required.

2. Optical Fiber Cable Safety

    a. The following warnings shall be posted on the job site:

        1) WARNING: PERMANENT EYE DAMAGE CAN RESULT FROM LOOKING DIRECTLY INTO A LIGHT BEAM GENERATED BY AN LED OR LASER SOURCE OR INTO THE END OF A CABLE FIBER CONNECTED TO ONE OF THESE SOURCES.
        2) CAUTION: LIGHT GENERATED BY THESE SOURCES MAY NOT BE VISIBLE, YET REMAINS HAZARDOUS TO THE EYE. LOOK FOR WARNING LABELS ON SOURCE DEVICES.

    b. Observe all warning signs on equipment and all written safety precautions in equipment instruction and technical manuals.

c. Always handle cable carefully to avoid personal injury. Care should be taken with individual fibers to prevent injury to the eyes or penetration of the fibers into the skin.

3. Hazardous Materials Prohibition

a. The Contractor shall ensure that all materials used in the project are asbestos-free, unless specifically authorized in writing by the Owner.

b. Applicable products shall comply with the European directives on the Restriction of Hazardous Substances (RoHS; 2002/95/EC) and Waste Electrical and Electronic Equipment (WEEE; 2002/96/EC).

B. Existing Conditions

1. Verify that all conditions on the project site applicable to the Work specified in this Section are as documented and are appropriate for the Work. Prior to bid opening, notify the Consulting Engineer, in writing, of any discrepancies, conflicts, or omissions. Otherwise, correct these issues at no additional cost to the Owner.
2. Continue to monitor the project site. If conditions develop that require a variance from the Specifications or Drawings, then immediately notify the Owner in writing. Otherwise, make recommendations, submit drawings showing how the Work may be installed, and, upon approval, proceed with the necessary changes without additional cost to the Owner.

C. Record Drawings

1. Keep a complete set of all telecommunications drawings in the job site office for demonstration of actual installation work under this Section.
2. Use this set of drawings for no other purpose.
3. When any material, equipment, or system components are installed differently than what is shown on the drawings, indicate the differences clearly and neatly using ink or indelible pencil.
4. Upon completion of the project, submit the record set of drawings.

1.09 USE OF THE SITE

A. Where the Owner deems it necessary to place restrictions, use the site as directed by the Owner.

B. When proceeding with the work, do not interfere with the ordinary use of streets, aisles, passages, exits, or operations of the Owner. During the day, set up cones and barriers in hallways and walkways. Do not string cable down the hallways during normal hours.

C. Request a hazardous materials worksheet that identifies potentially-hazardous locations. Do not proceed with any work in locations where hazardous materials are known to be. Obtain instructions from the Contractor's Project Manager on how and when to work in these areas.

D. Multiple times each day, each contractor shall remove all trash and debris from the site.

E. Before leaving the room each day:

1. The Contractor shall replace all ceiling tiles that they have removed.
2. The Contractor shall place all furniture and equipment that they have moved back into its original location.
3. The Contractor shall return any equipment that they have disconnected to working order.
4. The Contractor's Job Foreman shall inspect all work locations to ensure that the rooms are clean and that all of the tasks described above have been done.
5. It is recommended that the Contractor inspect the site and take pictures to document the

condition of the ceilings and walls.

1.10 CONTINUITY OF SERVICES

A. Take no action that will interfere with or interrupt the existing building services unless previous arrangements have been made with the Owner's representative. Arrange all work to minimize shutdown time.

B. The Owner's personnel shall perform shutdown of operating systems. When shutdown of systems is required, the Contractor shall give three (3) days advance notice.

C. Should building services be inadvertently interrupted:

1. The Job Foreman shall immediately notify the Project Manager of the accidental disruption of services, the remedy, and how long it will take to restore services.
2. The Contractor shall immediately furnish the labor, including overtime, the material, and the equipment necessary to promptly restore the interrupted service at no cost to the Owner.

1.11 WARRANTY

A. The Contractor shall provide the following warranties for the system and components.

1. Contractor Materials and Labor Warranty

a. The Contractor shall provide system warranties, for a period specified in the contract documents, against faulty materials and defects in workmanship. The Contractor shall also honor any manufacturer warranties that exceed this period of time.

2. Manufacturer Component Warranty

a. All components of the grounding and bonding system shall be free from manufacturing defects in material or workmanship, under normal and proper usage, for a minimum of one (1) year.

B. The Manufacturer shall bear the burden to replace or repair any defective products during the warranty period at their cost, including labor and materials.

C. The warranty period shall begin on the date of the Owner's Acceptance of the Work. Evaluation of quality and workmanship shall be solely by the Owner or the Owner’s representatives.

1.12 COMMISSIONING

A. Furnish one initial set of product brochures and owner’s manuals to the ***[Architect / Engineer / Owner]*** for use during acceptance testing and equalization.

PART 2 PRODUCTS

2.01 GENERAL NOTES

A. In this section, certain products are specified by manufacturer and part number to establish a level of quality, performance, and consistency. To substitute other products would defeat this effort to the Owner’s detriment. If no manufacturer or part number is specified for a part, then that part is generic, and the Contractor shall submit for approval a part that provides the performance specified herein.

B. All products, including but not limited to bonding lugs and busbars, shall be manufactured by Panduit.

C. All products, including but not limited to non-continuous cable supports, wire welded basket, cable runway, and non-metallic cable ducting shall be manufactured by Panduit. Owner Furnished Equipment (OFE) and materials shall be appropriate for the intended use and shall be recognized as such by a Nationally Recognized Testing Laboratory (NRTL), such as Underwriters Laboratories (UL), ETL SEMCO (ETL), the Canadian Standards Association (CSA), or the American National Standards Institute (ANSI).

D. All products shall be new, of the latest version at time of bid, and brought to the job site in the original manufacturer's packaging. Electrical components shall bear the UL or ETL label, and this listing requirement shall apply to the entire assembly. Only systems and equipment that meet or exceed the level of quality and the capabilities stated in this document will be considered for acceptance. Used equipment or damaged material will be rejected.

E. Any modifications to equipment to suit the intent of the specifications shall be performed in accordance with these requirements.

F. Take care during installation to prevent scratches, dents, chips, etc. Equipment with significant or disfiguring cosmetic flaws will be rejected.

G. All components will be approved by the Engineer and shall have the highest aesthetic value possible while providing the specified functionality. Hardware shall:

1. Be in compliance with the Construction Documents
2. Have fit and finish compatible with the existing surrounding structure
3. Be unobtrusive
4. Provide the required functionality

H. All work area termination hardware, including mounting boxes, faceplates, and outlets, shall match the existing wall surface color as closely as possible.

I. All copper and fiber optic cable products shall be from a single manufacturer so that a single performance warranty covers all applications on vertical and horizontal links.

J. Fabricate custom-made equipment with careful consideration given to the aesthetic, technical, and functional aspects of the equipment and its installation.

K. Provide products that are suitable for the intended use, for the environment in which they are to be installed, that meet regulatory requirements, and that comply with applicable electrical codes.

2.02 EARTHING AND BONDING MATERIALS

A. The Primary Bonding Busbar (PBB) shall be:

1. A solid, tinned copper bar, 4 inches wide by 20 inches long by 1/4 inch thick
2. Manufactured with holes evenly spaced horizontally and vertically throughout in accordance with the pattern specified by ANSI/TIA-607-C-1
3. Equipped with isolated mountings that provide a 2 inch standoff from the wall

B. The Secondary Bonding Busbar (SBB) shall be:

1. A solid, tinned copper bar, 2 inches wide by 10 inches long by 1/4 inch thick
2. Manufactured with holes evenly spaced horizontally and vertically throughout in accordance with the pattern specified by ANSI/TIA-607-C-1
3. Equipped with isolated mountings that provide a 2-inch standoff from the wall

C. Grounding Busbar for Racks and Enclosures

1. With each enclosure and rack, provide a tinned copper busbar to serve as an extension of the PBB or SBB for the equipment in the cabinet. The busbar shall:
    a. Be manufactured from copper alloy
    b. Be at least .75 inches (19 mm) wide, 19 inches (483 mm) long, and 0.1875 inches (5 mm) thick
    c. Have at least 14, factory-provided #12-24 threaded holes
    d. Have pre-punched EIA 310 D mountings, which match that of the vertical rail, for attachment to the mounting rail
    e. Be at least 0.67 inches (17 mm) wide, 78.65 inches (2 m) long, and 0.05 inches (1.27 mm) thick
    f. Include a hardware kit with rack installation hardware and with screws for bonding equipment to the busbar

D. The Telecommunications Bonding Conductor (TBC) shall be a UL listed, stranded conductor insulated with a green jacket. The TBC shall be equal in size to the TBB specified elsewhere in this Section.

E. The Telecommunications Bonding Backbone (TBB) shall be a UL-listed insulated earthing conductor sized as listed in the table below.

TBB Length	Gauge
<4 m (13 feet)	6 AWG
4-6 m (14-20 feet)	4 AWG
6-8 m (21-26 feet)	3 AWG
8-10 m (27-33 feet)	2 AWG
10-13 m (34-41 feet)	1 AWG
13-16 m (42-52 feet)	1/0 AWG
16-20 m (53-66 feet)	2/0 AWG
20-26 m (67-84 feet)	3/0 AWG
26-32 m (85105 feet)	4/0 AWG
32-38 m (106125 feet)	250 kcmil
38-46 m (126150 feet)	300 kcmil
46-53 m (151-175 feet)	350 kcmil
53-76 m (176-250 feet)	500 kcmil
76-91 m (251-300 feet)	600 kcmil
greater than 91 m (301 feet)	750 kcmil

F. The Mesh Bonding Network (MESH-BN) shall have:

1. #4 AWG or larger bare stranded conductors
2. Fault-rated connectors

G. The Equipment Bonding Conductors (EBCs) shall be #12AWG or larger stranded conductor with a green insulating jacket.

H. All bonding lugs shall be listed, and of the permanent two-bolt irreversible compression fitting type.

1. Lugs shall be constructed of tinned copper.
2. Barrels shall be color-coded with an inspection window.
3. Lugs shall comply with NEBS 3 requirements.

I. All taps shall be permanent compression type “C” or “H” taps.

2.03 ARMORED AND SHIELDED CABLE BONDING

A. Patch panels for use with shielded cabling in cabinets and racks shall be bonded to the supplemental telecommunications bonding system.

B. Armored or sheathed cable that does not have a metal jack or a means of electrically-continuous connection to the patch panel or equipment must have an individual jumper to tap into the armor or sheathing and to properly bond it to the supplemental telecommunications bonding system.

C. Armored or sheathed cable with a metal jack or means of electrically-continuous connection to the patch panel or equipment does not need to be individually bonded. However, the equipment must then be properly bonded back to the PBB or SBB via one of the following methods:

1. Bond a jumper from the equipment or cable, via an irreversible compression connection, to a Rack Bonding Conductor (RBC) that is connected to the Telecommunications Equipment Bonding Conductor (TEBC) that is bonded to the PBB or SBB.
2. Bond equipment via a jumper, with a 2 hole grounding lug, to a Rack Bonding Busbar (RBB) (vertical or horizontal) that is properly bonded to the TEBC and to the PBB or SBB.
3. If the equipment is electrically continuous and the rack is electrically continuous and bonded back to the TEBC or directly to the PBB or SBB, bond equipment to the rack via bonding hardware.
4. If the equipment has a 2-hole grounding lug landing area, then to comply with equipment manufacturers’ warranties, the landing area must be properly bonded back to the busbar.

D. If not otherwise stated, jumpers that are 6 AWG or larger are to be used.

Part number	Description	Unit of measure	Std. Pkg. Qty	Std. Ctn. Qty.
GB4B0624TPI-1	Grounding Busbar, BICSI 1/4" x 4" x 20" (6.4mm x 102mm x 508mm)	piece	1	--
GB2B0306TPI-1	Grounding Busbar, BICSI 1/4" x 2" x 12" (6.4mm x 51mm x 305mm)	piece	1	--
GB4B0612TPI-1	Grounding Busbar, BICSI 1/4" x 4" x 12" (6.4mm x 102mm x 305mm)	piece	1	--
GB2B0304TPI-1	Grounding Busbar, BICSI 1/4" x 2" x 10" (6.4mm x 51mm x 254mm)	piece	1	--

Part number	Description	Unit of measure	Std. Pkg. Qty	Std. Ctn. Qty.
RGCBNJ660P22	Jumper Kits, Common Bonding Network (CBN), #6 AWG (16mm²) Jumper, 60" (1.52m) Length	kit	1	--
RGCBNJ660PY	Jumper Kits, Common Bonding Network (CBN), #6 AWG (16mm²) Jumper, 60" (1.52m) Length	kit	1	--
RGRKCBNJY	Jumper Kit, Rack Grounding Retrofit Equipment	kit	1	--
RGRB19U	Grounding Busbar Kits, 19" (483mm) Lgth, 20 mounting holes, 5/8" (15.9mm) Hole Spacing	kit	1	--
RGRB19Y	Grounding Busbar Kits, 19" (483mm) Lgth, 14 mounting holes, 1/2" (12.7mm) Hole Spacing	kit	1	--
RGS134-1Y	Grounding Strip Kits, One, 78.65" (2m) x .67" (17mm) x .05" (1.27mm) Strip	kit	1	--
CGR630U	Complete grounding Kit for new installations on cabinets with 42 RUs, threaded #12-24 or M6 rail fasteners and rail depth up to 30" (0.75m)	kit	1	--
CGR630UB	Complete grounding Kit for new installations on cabinets with 42 RUs, cage nut rail fasteners and rail depth up to 30" (0.75m)	kit	1	--
RGREJ696Y	Jumper Kit, Rack Grounding Retrofit Equipment, #6 AWG (16mm²) Jumper, 96" (2.44m) Lgth.	kit	1	10
RGRKCBNJEJY	Jumper Kit, Rack Grounding Retrofit Equipment	kit	1	10
ACGKX	Armored cable grounding kit with one grounding terminal for #6 AWG and one #16 mechanical clamp, 15/16“, 1 1/2 diameter range	kit	1	--
ACGK	Armored cable grounding kit with one grounding terminal for #6 AWG and one #10 mechanical clamp, 9/16“, 1 1/16 diameter range	kit	1	--
CNBK	Bonding Cage Nut Kit	kit	1	--

Part number	Description	Unit of measure	Std. Pkg. Qty	Std. Ctn. Qty.
GPQC10-1/0	Access Floor Grounding Clamp, 7/8" (22.2mm) Square, 1-1 1/8" (25.4-28.6mm) Round	kit	1	--
RGESD2-1	ESD Port Kits, 2 Hole, 5/8" (15.9mm) Hole Spacing, Thread-Forming Screws	piece	1	20
RGESD2B-1	ESD Port Kits, 2 Hole, 5/8" (15.9mm) Hole Spacing, Cage Nuts	kit	1	20
RGESDWS	ESD Wrist Strap, 6' (1.8m) Cord, Blue	piece	1	--
RGTBSG-C	Bonding Screw, Green	piece	100	--
TRBSK	Bonding Threaded Rail Fastener Stud Kit, #12-24	kit	1	4
UGB2/0-414-12	12 Port Universal Ground Bar	kit	1	10
UGB-B-SO	Universal Ground Bar Bonding Stand-Offs	kit	1	10
UGB-IN-SO	Universal Ground Bar Insulation Stand-Offs	kit	1	10

PART 3 EXECUTION

3.01 GENERAL

A. Upon completion of work, a Registered Communications Distribution Designer (RCDD) shall submit as-built drawings to the Owner and Engineer.

B. Provide any necessary screws, anchors, clamps, tie wraps, distribution rings, miscellaneous grounding and support hardware, etc. necessary to facilitate the installation of the supplemental telecommunications bonding system.

C. Furnish any special installation equipment or tools necessary to properly complete the installation.

D. Any active equipment that does not have a built-in grounding terminal must include at least one thread-forming bonding screw or cage nut screw to bond that equipment to the rail on which it is being mounted.

E. Failure to follow the appropriate guidelines may require the installer to provide the additional material and labor required to bring the installation back into alignment with the guidelines.

F. All wiring, materials, and equipment must be listed and labeled by an NRTL. To certify performance characteristics that meet ANSI/TIA-568 Standards, provide all Original Equipment Manufacturer (OEM) documentation to the Owner.

G. All techniques and fixtures used in the installation must allow for easy maintenance of, and ready access to, all components for test measurements.

H. No self-tapping screws shall be used.

I. All parts shall be made of corrosion-resistant material, such as plastic, anodized aluminum, or brass.

J. All materials used in the installation shall be resistant to fungus growth and moisture deterioration.

K. To avoid corrosion caused by electrolysis between dissimilar metals under the environmental operating conditions specified, separate dissimilar with an inert dielectric material.

3.02 EARTHING AND BONDING

A. All bonding conductors, except Equipment Bonding Conductors (EBCs), installed as part of the supplemental telecommunications bonding system (earthing) shall be terminated to appropriately-sized two-hole compression rings or lugs. The routing of all conductors must be in lines as straight as possible (horizontal and vertical). To prevent undue deformation of the conductors, all changes in direction must have a minimum bend radius equal to four times the outer diameter of the conductor.

B. The TBC shall be provided from the building grounding electrode system in the electrical service entrance to the PBB, located in the Telecommunications Service Entrance Room (SE), by a tradesperson licensed by the Authority Having Jurisdiction.

C. A second bonding conductor will be installed from the PBB to a metallic structural element, which is effectively grounded, if available. The contractor shall coordinate with the Electrical Engineer to ensure available structural elements are effectively grounded. The use of interior water pipe system as a second bonding point is prohibited.

D. Install the PBB and SBBs in areas that are readily-accessible and are at convenient working heights above the finished floor. They must be fastened to the wall at all of the manufacturer-provided points on the standoffs using fasteners of the appropriate size and type. If attaching to drywall, first mount a piece of 18 inch by 4 inch by ¾ inch fire-rated AC plywood to the framing members, attaching in at least four places, then attach the SBB standoffs to the plywood backing.

E. In each equipment rack and cabinet, install a tinned copper busbar to the front mounting rails using fasteners provided by the equipment rack manufacturer.

F. Insulate the MESH-BN beneath the access floor as indicated on the Drawings.

1. Bond the MESH-BN conductor to the floor stanchions, using listed connectors appropriate for the application, at least every 10 linear feet.
2. Bond the MESH-BN to the SBB by means of an appropriate “H” type tap using a tap conductor of equal size to the MESH-BN conductor. Termination at the SBB shall be by means of an appropriately-sized two-hole compression lug.

G. Install the TBB between the PBB in the ER, and the SBB in each TR. The TBB shall be a #3/0 AWG or larger stranded conductor, and it must be sized to ensure a maximum DC resistance of five ohms (5 Ω) from each SBB to the building earthing electrode system.

H. Within each TR and the data center, have a tradesperson licensed by the Authority Having Jurisdiction bond the SBB to the TBB by means of an appropriate “C” type tap, using a #1 AWG or larger tap conductor, and to the electrical service earth at the nearest panel board.

I. Install a single EBC from the SBB and MESH-BN in the data center to the EGB. The EBC

shall:

1. Be UL-listed
2. Thermoplastic High Heat-resistant Nylon-coated (THHN)
3. Stranded #6 AWG or larger
4. Insulated with a green jacket
5. Terminated to a two-hole compression lug at each end
6. Fastened with appropriate fasteners

J. Bond all metallic equipment housings, enclosures, and cables shields contained in or terminated to an enclosure or relay rack to the mounting rails using a UL-listed THHN #12 AWG stranded conductor, insulated with a green jacket, and terminate it to a single-hole compression lug at each end, or bond it to the EGB using green paint-piercing conductive screws.

K. Ground the shields of cables on one end only in accordance with ANSI/TIA 607 B.

L. Use #6 AWG or larger stranded bonding conductors that have a green jacket and are fitted with permanent 2 hole compression lugs.

M. Use bonding conductors of sufficient length to be mechanically fastened to each rack, frame, and cabinet and the associated SBB or MESH BN.

N. When racks, frames, and cabinets are ganged together, do not serially bond (or daisy chain) them together. Provide each rack, frame, and cabinet with its own bonding conductor from the associated SBB or MESH-BN that is a #6 AWG or larger stranded insulated bonding bus. Tap it using permanent irreversible compression taps.

O. Mechanically fasten the end of the bonding conductor to the frame or rail of the rack, frame, or cabinet using two (2) flush fitting machine screws, star-washers, and nuts.

P. To prevent abrasion to cables, install screws placed on the interior face so that they are flush.

Q. Treat dissimilar metals with anti-corrosion compounds.

R. To ensure electrical continuity throughout the entire length of overhead metallic pathways, provide and install bonding conductors between each section of cable tray, on the exterior face of the lateral member of one side.

S. Provide and install bonding conductors as listed for overhead metallic basket-type tray pathways.

T. At the top of all conduit stub-ups (above the finished ceiling) greater than 36 inches (1 m) long, install appropriately-sized conduit bonding clamps.

U. On the corridor side of each sleeve greater than 36 inches long, install an appropriately-sized conduit bonding clamp.

END OF SECTION

SECTION 27 0528

PATHWAYS FOR COMMUNICATIONS SYSTEMS

PART 1 GENERAL

1.01 SUMMARY

A. This Section includes the specifications for cable pathway systems.

1. The materials and labor required for the installation of cable pathway systems include, but are not limited to:

a. Conduit
b. Cable runway or cable tray
c. Welded wire basket tray
d. Non-continuous cable supports
e. Nonmetallic cable duct

B. Related Drawings

1. T Series drawings

C. Furnish and install telecommunications pathways, including:

1. Conduit
2. Cable runway or cable tray
3. Welded wire basket tray
4. Non-continuous cable supports
5. Nonmetallic cable duct

D. What the Contractor Shall Provide and Install

1. Although such work is not specifically mentioned herein or on the drawings, the Contractor shall furnish and install, without claim for additional payment:

a. All miscellaneous items, accessories, appurtenances, and devices incidental to or necessary for a sound, secure, and complete installation
b. Accessories and equipment items needed for a complete system

E. Errors or Omissions in Drawings or Documentation

1. If any errors or omissions appear in Drawings, Specifications, or other documents, bidding Contractor shall notify Engineer no later than ten (10) days prior to submitting bid.
2. Should conflict occur in or between drawings and specifications, bidding Contractor is deemed to have estimated the more expensive way of doing the work, unless the bidding Contractor has asked for and obtained written decision (addendum), before submission of bid, as to which method or materials will be required.

F. Dimensions

1. The dimensions indicated are limiting dimensions.

a. Do not use equipment exceeding dimensions indicated.
b. Do not use equipment or arrangements that reduce required clearances or exceed specified maximum dimensions.

1.02 REFERENCES

A. Requirements, Codes, and Standards

1. Design, manufacture, test, and install telecommunications cabling networks per manufacturer's requirements and in accordance with latest revision of the NFPA-70 (the National Electrical Code®), state codes, local codes, requirements of Authorities Having Jurisdiction (AHJs), and the following standards, including the most current revisions, addenda, and any Technical Service Bulletins (TSB's) released at the time of bid, including:

   a. ANSI/NECA/BICSI-568-2006 -- Standard for Installing Commercial Building Telecommunications Cabling
   b. ANSI/NECA/BICSI 607-2011 – Standard for Telecommunications Bonding and Grounding Planning and Installation Methods for Commercial Buildings
   c. ANSI/BICSI- 002-2011 Data Center Design and Implementation Best Practices
   d. TIA-569 -- Commercial Building Standard for Telecommunications Pathways and Spaces
   e. TIA/EIA-606 -- Administration Standard for Commercial Telecommunications Infrastructure
   f. TIA-607 – Generic Telecommunications Bonding and Grounding (Earthing) for Customer Premises
   g. TIA-942 – Telecommunications Infrastructure Standard For Data Centers
   h. ASTM B 633 – Specification for Electrodeposited Coatings of Zinc on Iron and Steel ASTM A 653 – Specification for Steel Sheet, Zinc-Coated (Galvanized) by the Hot Dip Process
   i. ASTM A 510 – Specification for General Requirements for Wire Rods and Coarse Round Wire, Carbon Steel
   j. NEMA VE 1-2002/CSA C22.2 No. 126.1-02 – Metal Cable Tray Systems
   k. NEMA VE 2-2002 – Cable Tray Installation Guidelines
   l. ASTM A 641 – Standard Specification for Zinc-Coated (Galvanized) Carbon Steel Wire
   m. IEC 61537 (2001) – Cable Tray Systems and Cable Ladder Systems for Cable Management
   n. ASTM D 3363 - 05 Standard Test Method for Film Hardness by Pencil Test

B. Applicability of Codes, Rules, and Regulations

1. Federal, state, and local codes, rules, regulations, and ordinances governing the work are as fully part of the specifications as if herein repeated or hereto attached. If the Contractor notes items in the drawings or the specifications, construction of which would be code violations, the Contractor should promptly call them to the attention of the 'Owner's representative in writing. Where the requirements of other sections of the specifications are more stringent than the applicable codes, rules, regulations, and ordinances, the specifications shall apply.

C. Manufacturers' Recommendations

1. To maintain the applications warranties, install all pathways per the manufacturers' recommended installation practices.

D. Definitions

1. The following are the definitions of the terms used in this Section:

   a. AWG – American Wire Gauge – The standardized system for gauging the diameter of round, solid, non ferrous, electrically-conducting wire.
   b. BBC – Bonding Backbone Conductor – A telecommunication bonding connection which interconnects telecommunications bonding backbones. Formerly known as the grounding equalizer.
   c. BD – Building Distributor – A distributor in which the building backbone cables

terminate and at which connections to the campus backbone cables may be made.

d. BN – Bonding Network – A set of interconnected conductive structures that provides a low impedance path for the associated telecommunications infrastructure.
e. CP – Consolidation Point – A connection facility within Cabling Subsystem 1 for interconnection of cables extending from building pathways to the equipment outlet.
f. EDA – Equipment Distribution Area – A space allocated for end equipment, including computer systems and telecommunications equipment.
g. EF – Entrance Facility – An entrance to a building for both public and private network service cables, including wireless, that includes the entrance point of the building and continues to the entrance room or space.
h. ER – Equipment Room – An environmentally-controlled, centralized space for telecommunications equipment that serves the occupants of the building, distinct from a Telecommunications Room (TR) because of the nature or complexity of the equipment.
i. ESD – Electro Static Discharge – The sudden flow of electricity between two electrically-charged objects caused by contact, an electrical short, or dielectric breakdown.
j. HC – Horizontal Cross-connect – A group of connectors, such as patch panels or punch-down blocks, that allow horizontal, backbone, and equipment cabling to be cross-connected with patch cords or jumpers.
k. HDA – Horizontal Distribution Area – A space in a computer room where a Horizontal Cross-connect (HC) is located and which may include LAN switches, Storage Area Network (SAN) switches, and Keyboard/Video/Mouse (KVM) switches for the end equipment located in the equipment distribution areas.
l. IC – Intermediate Cross-connect – A facility enabling the termination of different levels of backbone cabling and interconnection between them or equipment.
m. MC – Main Cross-connect – A facility enabling the termination of backbone cables and their connection to incoming services, other backbone cabling, or equipment.
n. MDA – Main Distribution Area – The central point of distribution for the structured cabling system, which includes the Main Cross-connect (MC) and, when equipment areas are served directly from the MDA, may also include Horizontal Cross-connect (HC).
o. Mesh-BN – Mesh Bonding Network – A bonding network to which all associated equipment, such as cabinets, frames, racks, trays, and pathways, are connected using a bonding grid that is connected to multiple points on the common bonding network.
p. PBB – Primary Bonding Busbar – A busbar placed in a convenient and accessible location and bonded, by means of the Telecommunications Bonding Conductor (TBC), to the building's service equipment (power) ground. Formerly known as the Telecommunications Main Grounding Busbar (TMGB).
q. RBB – Rack Bonding Busbar – A busbar within a cabinet, frame, or rack.
r. RBC – Rack Bonding Conductor – A bonding conductor from the rack or Rack Bonding Busbar (RBB) to the Telecommunications Equipment Bonding Conductor (TEBC).
s. RU – Rack Unit – A unit of measure, compliant with EIA 310, used to describe the height of equipment intended for mounting on equipment rails. One RU is 1.75 inches (44.45 mm) high.
t. SBB – Secondary Bonding Busbar – A common point of connection for telecommunications system and equipment bonding to ground, located in the distributor room. Formerly known as the Telecommunications Grounding Busbar (TGB).
u. TBB – Telecommunications Bonding Backbone – The conductor that interconnects the Primary Bonding Busbar (PBB) to the Secondary Bonding Busbar (SBB).
v. TBC – Telecommunications Bonding Conductor – A conductor that interconnects

the telecommunications bonding infrastructure to the building's service equipment (power) ground. Formerly known as the bonding conductor for telecommunications.

w. TEBC – Telecommunications Equipment Bonding Conductor – A conductor that connects the Primary Bonding Busbar (PBB) or Secondary Bonding Busbar (SBB) to equipment racks or cabinets.

x. TO – Telecommunications Outlet – A connecting device, located in a work area, at which the horizontal cabling terminates.

y. TR – Telecommunications Room – An enclosed space for housing telecommunications equipment, cable terminations, and cross-connect cabling. It is the recognized location of the cross-connect between the backbone and horizontal facilities.

z. UBC – Unit Bonding Conductor – A bonding conductor from equipment or a patch panel to a Rack Bonding Conductor (RBB) or a Rack Bonding Busbar (RBB).

aa. ZDA – Zone Distribution Area – A space where a zone outlet or consolidation point is located, between the horizontal and equipment distribution areas, that allows frequent reconfiguration and flexibility.

1.03 PERMITS, FEES, AND CERTIFICATES OF APPROVAL

A. If required, the Owner or Owner's authorized agent will make application for and pay for any building permits. ***– Edit or remove this as needed for the intended project.***

1.04 SYSTEM DESCRIPTION

A. Pathways and Raceways

1. Pathways and Raceways are the support system for the infrastructure. All pathways and raceways shall conform to the TIA-569-B Commercial Building Standard for Pathways and Spaces. All horizontal and backbone cable shall be properly supported every 48" to 60" inches. Infrastructure Support Systems include, but may not be limited to, the following:

   a. Cable-trays, which shall be properly supported
   b. Conduits, both inside or outside, both above ground or underground, all of which shall be properly supported
   c. Non-continuous cable supports, which shall be spaced no more than 60" inches apart
   d. Surface Raceway systems, which are to be non-metallic raceways and boxes

2. A combination of cable tray, conduit, and non-continuous cable supports are preferred. Cable-trays shall be used for main corridor cable pathways on all levels. The primary cable routes will be located over corridors for easy maintenance and access.
3. To protect all cables from damage and to provide a suitable aesthetic appearance in areas where the cable may be exposed, such as in rooms with open-ceilings, conduit or surface raceway must be used instead of non-continuous cable supports.
4. Conduit routes shown on the project drawings are indicative of the design intent and desired routing. The Contractor is responsible for detailed routing within the facility and shall coordinate the detailed routing with the Owner.

1.05 SUBMITTALS

A. Engineer's Review

1. The Engineer's review of shop drawings or samples shall not relieve the Contractor of responsibility for any deviation from the contract documents.
2. The Contractor shall include, with the shop drawings, an index sheet detailing all deviations from the contract documents and will be held responsible for all deviations, unless the Contractor has received written approval from the Engineer for the specific

deviation, separate from general shop drawing approval.

3. The Engineer's review shall not relieve the Contractor from responsibility for errors or omissions in the shop drawings or samples.

B. For all products, the Contractor shall submit the following data for each component covered under this Section:

1. A Specification Section reference
2. The Manufacturers name
3. The Manufacturers model number and part number
4. Data sheets
5. Specifications, including size, construction, and finish
6. Fabrication and installation details of cable trays, including plans, elevations, and sections of components and attachments to other construction elements, designating components and accessories, including clamps, brackets, hanger rods, splice connectors, straight lengths, and fittings
7. Coordination drawings, including floor plans and sections drawn to scale, on which the following items are shown and coordinated with each other using input from installers:

a. A scaled cable tray layout that includes the relationships between components and adjacent structural, electrical, and mechanical elements
b. Vertical and horizontal offsets and transitions
c. Clearances for access above and to the side of cable trays
d. Vertical elevation of cable trays above the floor or below the bottom of the ceiling structure

1.06 QUALITY ASSURANCE

A. Standards for Materials, Equipment, and Installation

1. The Contractor shall provide all materials and equipment, and shall install them in compliance with the latest applicable standards from ANSI, FCC, ASTM, EIA/TIA, IEEE, NEC, NFPA, NEMA, OSHA, REA, and UL.

a. NEMA Compliance: All materials, equipment, and installation shall comply with the following NEMA standards:

1) NEMA Standards Publication Number VE1, "Cable Tray Systems"
2) NEMA Standards Publication Number VE2, "Cable Tray Installation Guidelines"

2. NEC Compliance

a. All materials, equipment, and installation shall comply with NEC Article 318, as applicable to construction and installation of cable tray and cable channel systems.

B. UL Compliance

1. The Contractor shall provide products that are UL classified and labeled.

C. NFPA Compliance

1. The Contractor shall comply with all NFPA 70B, "Recommended Practice for Electrical Equipment Maintenance" standards pertaining to installation of cable tray systems.

D. TIA-569-D-1 Compliance

1. The Contractor shall comply with Telecommunications Industry Association TIA-569-D-1 "Commercial Building Standards for Telecommunications Pathways and Spaces."

E. BICSI TDMM Compliance

1. The Contractor shall comply with Building Industry Consulting Service International's (BICSI's) Telecommunications Distribution Methods Manual (TDMM).

F. Installer Qualifications ***– Edit or Remove as necessary for the intended project.***

1. Registered Communications Distribution Designer (RCDD)

a. The Contractor must have at least one (1) Registered Communications Distribution Designer (RCDD) as recognized by Building Industry Consulting Service International (BICSI). The RCDD must be a full-time employee of the Contractor, and shall be responsible for the compliance of work with the referenced standards and guidelines. At the time of bid, the RCDD shall provide a professional resume and proof of current registration shall be supplied to the Engineer for approval. The RCDD shall be present during construction and all cable testing and shall have:

1) Knowledge of BICSI installation standards
2) Knowledge of NEC standards
3) Knowledge of ANSI/TIA standards
4) Five (5) years of experience in the installation of optical fiber cables, including splicing, terminating, and testing, including single-mode and multi-mode
5) Three (3) years of experience in the installation of Balanced Twisted Pair (BTP) copper cables for voice and data distribution systems, including splicing, terminating, testing, and complete verification of compliance with ANSI/TIA cable standards
6) Five (5) references for projects of equivalent scope, type, and complexity with work completed within the last five (5) years – The Contractor shall submit, as proof, supporting documents and the names, addresses, and telephone numbers of the operating personnel who can be contacted regarding the installation system.
7) Certification by the termination equipment manufacturer as an installer

G. Other Installers

1. Products shall only be installed by qualified technicians certified by the product manufacturers.

H. Compliance with Laws, Ordinances, and Codes

1. Comply in every way with the requirements of local laws and ordinances, the National Board of Fire Underwriters, and the National Electrical Code. Anything in the plans or specifications that does not strictly comply with the above laws, ordinances, and rules must be referred to the attention of the Engineer for a decision before proceeding. No change in the plans or specifications shall be made without full consent, in writing, of the Engineer.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Handling

1. To prevent damage, theft, soiling, and misalignment, protect equipment during transit, storage, and handling. Protect equipment during transit, storage, and handling.

B. Storage

1. The Contractor shall coordinate the secure storage of equipment and materials on-site, or, if no on-site storage is available, shall provide their own secure storage at the Contractor's expense.

a. Do not store equipment where conditions fall outside manufacturer's

recommendations for environment.

b. Do not install damaged equipment. Remove from site and replace damaged equipment with new equipment.

c. If off-site storage of materials is necessary, this shall be at the Contractor's expense.

1.08 COORDINATION

A. Installation Schedule

1. The contractor shall coordinate with all other trades. The Contractor will submit a schedule for the installation within 10 days of contract award.

a. The schedule shall include delivery, installation, and testing for conformance to specific job completion dates.

b. At a minimum, dates are to be provided for the start of installation, the completion of station cabling, the completion of riser cabling, the completion of testing and labeling, cutover, the completion of the final punch list, the start of demolition, the completion of demolition, final inspection, and acceptance.

B. Meeting Attendance and Schedule Adherence

1. The Contractor must attend all project related meetings and adhere to the schedule set by the project manager.

C. Final Inspection

1. The contractor is required to notify the Engineer of a proposed appointment for Final Inspection at least 72 hours before the appointment.

2. Within five working days after the final inspection, the Contractor shall send final project documentation and warranty information to the Owner and Architect. The final project documentation shall include, but may not be limited to the following:

a. As Built Drawings, with legible outlet address and cable paths, in an AutoCAD format listed in this Section

b. Outlet location spreadsheets

c. Warranty Paperwork

d. A copy of the Final Inspection and Acceptance Sign-off Sheet

e. Photos of each ER and TR

1.09 PROJECT CONDITIONS

A. Project Environmental Requirements

1. Seismic Safety

a. Provide mechanical and electrical support for all installed equipment as required by all applicable local building codes for this installation's earthquake risk hazard zone and as recommended by Telcordia Specification GR-63.

b. Anchor all equipment racks with suitable anchors that meet safety standards.

c. Mount overhead devices with appropriate safety attachments as required.

d. Where cabinets and racks are secured directly to the building it will need to be done so in accordance with guidance provided by the Authority Having Jurisdiction (AHJ) or a structural engineer.

e. Provide shock and vibration isolation of equipment and fixtures as required.

2. Fiber Optic Cable Safety

a. The following warnings shall be posted on the job site:

1) WARNING: PERMANENT EYE DAMAGE CAN RESULT FROM LOOKING

DIRECTLY INTO A LIGHT BEAM GENERATED BY AN LED OR LASER SOURCE OR INTO THE END OF A CABLE FIBER CONNECTED TO ONE OF THESE SOURCES.

2) CAUTION: LIGHT GENERATED BY THESE SOURCES MAY NOT BE VISIBLE, YET REMAIN HAZARDOUS TO THE EYE. LOOK FOR WARNING LABELS ON SOURCE DEVICES.

b. Observe all warning signs on equipment and all written safety precautions in the instruction manual or equipment technical manual.

c. Always handle cable carefully to avoid personal injury. Care should be taken with individual fibers to prevent injury to the eyes or penetration of the fibers into the skin.

3. Hazardous Materials Prohibition

a. The contractor shall ensure that all materials used in the project are asbestos-free, unless specifically authorized in writing by the Owner.

b. Applicable products shall comply with the European directives on the Restriction of Hazardous Substances (RoHS; 2002/95/EC) and Waste Electrical and Electronic Equipment (WEEE; 2002/96/EC).

B. Existing Conditions

1. Verify all project site conditions applicable to the Work of this Section. Notify the Consulting Engineer in writing of any discrepancies, conflicts, or omissions prior to bid opening. Otherwise, correct these at no additional cost to the Owner.
2. Continue to monitor the project site. If conditions develop requiring a need to vary from the Specifications or Drawings, notify the Owner immediately in writing. Otherwise, make recommendations, submit drawings showing how the Work may be installed, and on approval, proceed with the necessary changes without additional cost to the Owner.

C. Record Drawings

1. Keep a complete set of all telecommunications drawings in the job site office for demonstration of actual installation work under this Section.
2. Use this set of drawings for no other purpose.
3. Where any material, equipment, or system components are installed differently than what is shown on the drawings, indicate differences clearly and neatly using ink or indelible pencil.
4. Upon completion of the project, submit the record set of drawings.

1.10 USE OF THE SITE

A. Where the Owner deems it necessary to place restrictions, use the site as directed by the Owner.

B. When proceeding with the work, do not interfere with the ordinary use of streets, aisles, passages, exits, or operations of the Owner. During the day, set up cones and barriers in hallways and walkways. Do not string cable down the hallways during normal hours.

C. Request a hazardous materials worksheet that identifies potentially-hazardous locations. Do not proceed with any work in locations where hazardous materials are known to be. Obtain instructions from the Contractor’s Project Manager on how and when to work in these areas.

D. Multiple times each day, each contractor shall remove all trash and debris from the site.

E. Before leaving the room each day:

1. The Contractor shall replace all ceiling tiles that they have remove.
2. The Contractor shall place all furniture and equipment that they have moved back into its original location.
3. The Contractor shall return any equipment that they have disconnected to working order.
4. The Contractor's Job Foreman shall inspect all work locations to ensure that the rooms are clean and that all of the tasks described above have been done.
5. It is recommended that the Contractor inspect the site and take pictures to document the condition of the ceilings and walls.

1.11 CONTINUITY OF SERVICES

A. Take no action that will interfere with or interrupt the existing building services unless previous arrangements have been made with the Owner's representative. Arrange all work so as to minimize shutdown time.

B. The Owner's personnel shall perform shutdown of operating systems. When shutdown of systems is required, the contractor shall give three (3) days' advance notice.

C. Should services be inadvertently interrupted:

1. The Job Foreman shall immediately notify the Project Manager of any accidental disruption of services, the remedy, and how long it will take to restore services.
2. The Contractor shall immediately furnish the labor, including overtime, the material, and the equipment necessary to promptly restore the interrupted service at no cost to the Owner.

1.12 WARRANTY

A. The Contractor shall provide the following warranties for the system and components.

1. Contractor Materials and Labor Warranty

a. The Contractor shall provide system warranties, for a period specified in the contract documents, against faulty materials and defects in workmanship. The Contractor shall also honor any manufacturer warranties that exceed this period of time.

2. Manufacturer Component Warranty

a. All components of the telecommunications pathway systems shall be free from manufacturing defects in material or workmanship, under normal and proper usage, for a minimum of one (1) year.

B. The Manufacturer shall bear the burden to replace or repair any defective products during the warranty period at their cost, including labor and materials.

C. The warranty period shall begin at the date of the Owner's Acceptance of the Work. Evaluation of quality and workmanship shall be solely by the Owner or the Owner's representatives.

1.13 COMMISSIONING

A. Furnish one initial set of product brochures and owner's manuals to the ***[Architect / Engineer / Owner]*** for use during acceptance testing.

B. Operation Manual

1. The Contractor shall provide an Operations Manual. This manual and all related documentation shall be property of the owner and shall include the following:

a. A Table of Contents

b. Typed description of each pathway system, including key features and operational concepts (such as under floor basket, overhead basket, overhead cable duct)
c. Setup diagrams and typed instructions for use in typical situations, as directed by the Architect's Consultant Engineer
d. Small-scale plans showing the locations of all pathway systems

C. Maintenance Data Manual

1. The Contractor shall provide an Operations Manual. This manual and all related documentation shall be property of the owner and shall include the following:

a. A Table of Contents
b. The company name, address, telephone number, and contact name for system service or maintenance
c. A listing of all equipment and materials with names of manufacturers and model numbers or part numbers.
d. Catalog data sheets displaying manufacturer's names, addresses, and telephone numbers
e. Product manufacturers' warranties that explicitly cover all materials and labor
f. Manufacturers' service manuals for all major equipment items
g. Test documentation showing the results of source quality control tests, field quality control tests, acceptance testing, and certification
h. A recommended preventative maintenance schedule with reference to the applicable pages in the manufacturer's maintenance manuals And, where inadequate information is provided by the manufacturer, the information required to perform proper maintenance

PART 2 PRODUCTS

2.01 GENERAL NOTES

A. In this section, certain products specified by manufacturer and part number to establish a level of quality, performance, and consistency. To substitute other products would defeat this effort to the Owner's detriment. If no manufacturer or part number is specified for a part, then that part is generic, and the Contractor shall submit for approval a part that provides the performance specified herein.

B. All products, including but not limited to non-continuous cable supports, wire welded basket, cable runway, and non-metallic cable ducting shall be manufactured by Panduit. Owner Furnished Equipment (OFE) and materials shall be appropriate for the intended use and shall be recognized as such by a Nationally Recognized Testing Laboratory (NRTL), such as Underwriters Laboratories (UL), ETL SEMCO (ETL), the Canadian Standards Association (CSA), or the American National Standards Institute (ANSI).

C. All products shall be new, of the latest version at time of bid, and brought to the job site in the original manufacturer's packaging. Electrical components shall bear the UL or ETL label, and this listing requirement shall apply to the entire assembly. Only systems and equipment that meet or exceed the level of quality and the capabilities stated in this document will be considered for acceptance. Used equipment and damaged material will be rejected.

D. Any modifications to equipment to suit the intent of the specifications shall be performed in accordance with these requirements.

E. Materials shall be listed and approved for the particular application and permitted by the Authority Having Jurisdiction (AHJ) for the application.

F. Take care during installation to prevent scratches, dents, chips, etc. Equipment with significant

or disfiguring cosmetic flaws will be rejected.

G. All components will be approved by the Engineer and shall have the highest aesthetic value possible while providing the specified functionality. Hardware shall:

1. Be in compliance with the Construction Documents
2. Have fit and finish compatible with the existing surrounding structure
3. Be unobtrusive
4. Provide the required functionality

H. Fabricate custom-made equipment with careful consideration given to the aesthetic, technical, and functional aspects of equipment and its installation.

I. Provide products that are suitable for the intended use, for the environment in which they are to be installed, that meet regulatory requirements, and that comply with applicable electrical codes.

2.02 CONDUIT

A. Sizing of Conduit

1. The conduit used shall:

a. Be at least trade size 1-1/4
b. Have capacity for 50% expansion
c. Be large enough so that cables occupy no more than 40% of the internal area of each conduit
d. Be large enough to accommodate multiple cables based on the sum of the cross-sectional area of all cables to be installed

B. Conduit as Horizontal Raceway

1. Conduit shall be used as a horizontal raceway system for telecommunications cabling when:

a. It is required by code
b. Termination locations are permanent
c. Device densities are low
d. Special mechanical protection is required
e. Flexibility is not required

C. Flexible Conduit

1. The use of flexible metal conduit is not permitted. If flexible conduit is required, it must meet the following requirements.

a. Each run shall be less than 6 m (20 feet) long.
b. The conduit selected shall minimize cable abrasion during the installation of cables.
c. To facilitate subsequent placement of additional cable in a single pathway, Innerduct or subduct may be used, in accordance with appropriate codes.

D. Conduit Length

1. No section of conduit shall be longer than 30 m (100 feet) between pull points.

E. Bends

1. No section of conduit shall contain more than two 90º bends, or equivalent, between pull points (such as outlet boxes, pull boxes, or distributor rooms). If there is a reverse (U

shaped) bend in the section, a pull box shall be installed sized in accordance with ANSI/TIA-569-D-1.

2. For conduits with an internal diameter of 2 inches (50 mm) or less, the inside radius of a bend in conduit shall be at least 6 times the internal diameter.
3. For conduits with an internal diameter of more than 2 inches (50 mm), the inside radius of a bend in conduit shall be at least 10 times the internal diameter.
4. Bends in the conduit shall not contain any kinks or other discontinuities that may have a detrimental effect on the cable sheath during cable pulling operations.

F. Pull Tension

1. The pull tension of the cable being installed shall not be exceeded. Some factors that determine pull tension of cable include:

    a. Conduit size
    b. Length of conduit
    c. Location and severity of bends
    d. Cable jacket material
    e. Cable weight
    f. Number of cables
    g. Conduit material
    h. Lubricants
    i. Direction of pull
    j. Firestopping

2. Cable pulling tensions may be reduced by using lubricants. Use care in selecting a lubricant, taking into consideration compatibility with cable jacket composition, safety, lubricity, adherence, stability, and drying speed.

G. Pull Boxes

1. Pull boxes shall be used for:

    a. Fishing the conduit run
    b. Installing a pull string or cable
    c. Pulling the cable to the box and then looping the cable to be pulled into the next length of conduit (Usually, this is only done with smaller diameter cables and not with cables with a diameter of 64 mm [2½ inches] or more.)

2. Conduit fittings shall not be used in place of pull boxes.
3. Pull boxes shall be readily accessible and shall not be placed in a fixed false ceiling space, unless immediately above a suitably-marked access panel.
4. A pull box shall be placed in a conduit run where:

    a. The run is over 30 m (100 feet) long
    b. There are more than two 90º bends, or equivalent
    c. There is a reverse (U-shaped) bend in the run

5. Pull boxes shall be placed in a straight section of conduit and shall not be used in lieu of a bend. The corresponding conduit ends should be aligned with each other.
6. Where a pull box is required with conduits smaller than metric designator 35 (trade size 1¼), a four-square outlet box may be used.
7. Where a pull box is used with conduits larger than metric designator 35 (trade size 1 ¼), it shall be sized as listed in the following table:

Metric Designator	Trade Size	Width mm (in)	Length	Depth	Width increase For additional Conduit
27	1	102 mm (4 inches)	406 mm (16 inches)	76 mm (3 inches)	51 mm (2 inches)
35	1¼	152 mm (6 inches)	508 mm (20 inches)	76 mm (3 inches)	76 mm (3 inches)
41	1½	203 mm (8 inches)	686 mm (27 inches)	102 mm (4 inches)	102 mm (4 inches)
53	2	203 mm (8 inches)	914 mm (36 inches)	102 mm (4 inches)	127 mm (5 inches)
63	2½	254 mm (10 inches)	1067 mm (42 inches)	127 mm (5 inches)	152 mm (6 inches)
78	3	305 mm (12 inches)	1219 mm (48 inches)	127 mm (5 inches)	152 mm (6 inches)
91	3½	305 mm (1 inches 2)	1372 mm (54 inches)	152 mm (6 inches)	152 mm (6 inches)
103	4	381 mm (15 inches)	1524 mm (60 inches)	203 mm (8 inches)	203 mm (8 inches)

8. If the pull box is comprised of metallic components, it shall be bonded to ground in accordance with the Authority Having Jurisdiction (AHJ).

H. Pathway Termination

1. To prevent poured concrete from entering conduits protruding through the the distributor room floor during construction and to protect cabling and firestop materials from water and other liquid spills, such conduits shall be terminated 25 to 75 mm (1 to 3 inches) above the floor surface.

I. To prevent partial bend transitions through the wall and to ensure that the cable is at a height that may be fed to connecting hardware without interfering with equipment racks or back panels, conduits within the ceiling shall protrude into the room from 25 to 75 mm (1 to 3 inches), without a bend, and above the 2.4 m (8 foot) level.

2.03 NON-CONTINUOUS CABLE SUPPORTS

A. Non-continuous cable supports must:

1. Have a cable-bearing surface on the bottom that is at least equal to the full radius of the cable
2. Maintain complete horizontal and vertical bend radius control of 1 inch
3. Have 90° radius edges to prevent damage while installing cables
4. Be designed so that the mounting hardware is recessed to prevent cable damage
5. Have a removable and reusable hook and loop retainer to contain the cables within the hook
6. Be factory-assembled for direct attachment to walls, hanger rods, beam flanges, purlins, struts, floor posts, etc. as needed for various on-site conditions
7. Be manufactured from a non-conductive material suitable for use in air-handling spaces

B. To provide separate cabling compartments or where additional capacity is needed, multi-tiered non-continuous cable supports shall be used.

2.04 FIBER RUNNER – NONMETALLIC CABLING DUCT

A. Nonmetallic cabling duct shall be used to segregate and route cables between the equipment racks and cabinets in the data center. The nonmetallic cabling duct system shall include, but is

not limited to, straight sections of channel, covers, couplers, fittings, and brackets.

B. Nonmetallic Cabling Duct Materials

1. The channel and all nonmetallic system components shall be manufactured with UL-recognized materials that exhibit nonflammable self-extinguishing characteristics of UL94 (V 0).

   a. The base and cover shall be manufactured of a rigid PVC material.
   b. Molded fittings shall be manufactured of a rigid ABS material.
   c. Acceptable colors are yellow, orange, or black.

C. Channel and Cover

1. The nonmetallic cabling duct system channel and cover shall meet the following requirements:

   a. It shall have a two-piece design, with a base and cover.
   b. To retain and inhibit cover movement, it shall have an integral high-friction design.
   c. The inch by 4 inch (305 mm x 100 mm), the 6 inch by 4 inch (150 mm 100 mm), and the 4 inch by 4 inch (100 mm x 100mm) covers shall snap on the base and shall hinge from one side.
   d. The 2 inch by 2 inch (51 mm x51 mm) covers shall snap on the base and hinge from both sides.

D. Couplers

1. Couplers shall be used at each connection.
2. Each fitting-to-fitting, channel-to-fitting, and channel-to-channel connection shall require a coupler.
3. Couplers shall be supplied pre-assembled. They shall be ready to use they shall not require any bolts to fasten, nor shall any adjustments need to be made.
4. The coupler shall be removable when needed.

E. Fittings

1. A full complement of fittings must be available including, but not limited to, 45° and 90° flat, vertical, inside and outside elbows, horizontal and vertical tees, cross fittings, spillouts, reducers, end caps, and all other components required to make the system workable.
2. Snap-on split covers shall be available for all directional fittings.
3. The fittings shall be capable of maintaining a minimum cable bend radius of 2 inches (51 mm).
4. All fitting bases and covers shall be supplied as separate components, except for the 2 inch by 2 inch (51 mm x 51 mm) size, where the fitting bases and covers are supplied together.

F. System Spillouts and Accessories

1. Multiple spillout options shall be provided to accommodate the safe transition from horizontal to vertical runs into various equipment and rack configurations.
2. The spillout options shall include, but are not limited to, channel, slotted channel, and corrugated loom tubing.

G. Adapters to Competitive Systems

1. To help facilitate the transition from other existing pathway systems to the selected system, adapters shall be offered in various sizes.
2. The other existing pathway systems that must be accommodated include, but are not

limited to, ADC, Ditel, Hellerman Tyton, Newton, Telect, and Warren & Brown.

H. Mounting Brackets

1. A full complement of mounting brackets must be available, including, but not limited to, new and existing threaded rod bracket kits, wall bracket kits, cabinet bracket kits, equipment rack kits, and all other components necessary to make the system workable.
2. The mounting brackets shall be manufactured from commercial grade cold-rolled steel with zinc chromate, e-coating, or painted black powder coat finish.
3. The channel shall be attached to the brackets by securing the bracket slide clamps to the rail on the bottom of the channel base.

2.05 WYRGRID – OVERHEAD CABLE TRAY

A. NFPA 70

1. Cable trays and accessories shall be as defined in NFPA 70 and shall be marked for intended location, application, and grounding.

B. Source Limitations

1. Obtain cable trays and components from Panduit in compliance with the requirements outlined in in this specification.

C. Sizes and Configurations

1. Provide cable trays and accessories of the types, materials, sizes, and configurations specified by the cable tray drawings.

D. Structural Performance

1. The cable tray must be capable of supporting a uniformly-distributed load on the indicated support span when supported as a simple span and tested according to NEMA VE 1.
   a. Concentrated Load: A load applied at midpoint of span and centerline of tray.
   b. Load and Safety Factors: Applicable to both side rails and rung capacities.

E. Configuration

1. The cable tray shall be formed of a standard 3.7 inch (94 mm) by 5 inch (127 mm) wire mesh pattern with intersecting wires welded together. The mesh sections must have at least one bottom longitudinal wire along entire length of the section.
2. To minimize cutting on straight sections and eliminate cutting at intersections, straight sections of the cable tray shall be furnished without integral sidewalls.
3. To retain cables within the cable tray system, optional snap-on sidewalls shall be installed where needed.
4. To accommodate future cabling requirements without having to replace the cable tray, the optional snap-on sidewalls must be removable, so that they can be replaced with larger sidewalls.

F. Materials

1. The cable tray shall have high-strength steel longitudinal wires with no bends.

G. Safety Provisions

1. To protect the cables from damage and installers from injury, the wire ends along the wire-mesh pathway shall be rounded during manufacturing.

H. Sizes

1. Straight sections of the cable tray shall be furnished in standard 118 inch (3000 mm) lengths.
2. Straight sections of the cable tray shall be furnished in four standard widths:
    a. 12 inches (305 mm)
    b. 18 inches (457 mm)
    c. 24 inches (610 mm)
    d. 30 inches (762 mm)
3. Optional snap-on sidewalls shall be offered in three height configurations:
    a. 2 inches (51 mm
    b. 4 inches (102 mm)
    c. 6 inches (152 mm)
4. The available loading width in the cable tray shall match the width listed above for the cable tray deployed and the available loading depth in the cable tray shall match the height listed above for the snap-on sidewalls deployed.

I. Splice Connectors

1. Splice connectors shall allow for two sections of the cable tray to be quickly joined.
2. To ensure electrical continuity throughout the cable tray system, the cable tray shall have an integrated screw feature that mechanically bonds continuous pathway sections.
3. Neither splices in the support span nor intersections shall diminish the rated loading capacity of the cable tray.

J. Materials and Finishes

1. The cable tray shall:
    a. Have straight sections and side rail fittings and rungs that are constructed of steel that complies with the minimum mechanical properties of ASTM A 1008/A 1008M
    b. Have steel splice connectors that comply with SAE/AISI 1095
    c. Be mill-galvanized before fabrication in compliance with ASTM A 653/A 653M
    d. Have a factory-applied powder-coat enamel paint finish and a corrosion-inhibiting treatment
    e. Be electro galvanized before fabrication in compliance with ASTM B 633

K. Cable Tray Accessories

1. The cable tray system shall have tees, crosses, risers, elbows, and other fittings, as indicated, constructed of the same materials and with the same finishes as the cable tray.
2. The cable tray supports and connectors, including bonding jumpers, shall be as recommended by the cable tray manufacturer.
3. The table below lists part numbers and sizes. This is a small subset of the number available. For additional information, contact Panduit customer service or refer to the current parts catalog.

Part number	Description	Unit of measure	Std. Pkg. Qty	Std. Ctn. Qty.
WG12BL10	Wyr-Grid Pathway, 12” W x 10’ L, Black Powder Coated	foot	10	--
WGINTBRC4BL	Intersection Bend Radius Control, 4” High, Wyr-Grid, Black Powder Coated	piece	1	--

Part number	Description	Unit of measure	Std. Pkg. Qty	Std. Ctn. Qty.
WGSW4BL	Sidewall, 4” High, Wyr-Grid, Black Powder Coat	piece	1	40
WGINTSPLBL	Intersection Splice for Wyr-Grid Pathway, Black Powder Coated	piece	1	10
WGSPL1218BL	Splice Connector for 12” to 18” Wide Wyr-Grid Pathway, Black Powder Coated	piece	1	10
WGBTMWFBL	Bottom Waterfall for Wyr-Grid Pathway, Black Powder Coated	piece	1	10
WGSWF4BL	Side Waterfall for Wyr-Grid Pathway	piece	1	5
WGTBS12BL	Bracket, Trapeze, 12”, Wyr-Grid, Black	piece	1	5
WGWMTB12BL	Bracket, Wall Mount, 12” Width, Wyr-Grid, Black Powder Coated	piece	1	5
FR6X4YL6	Channel, 6” x 4” (150mm x 100mm), 6’, FiberRunner, YL	foot	6	36
FRHC6YL6	Channel Cover, Hinged, Snap-On, 6” x 4” (150mm x 100mm), 6’, FiberRunner, YL	foot	6	36
FRSHC6YL6	Channel Cover, Split Hinged Snap-On, 6” x 4” (150mm x 100mm) 6’, FiberRunner, YL	foot	6	36
FRBC6X4YL	Coupler, 6” x 4” (150mm x 100mm), FiberRunner, YL	piece	1	5
FREC6X4YL	Fitting, End Cap, 6” x 4” (150mm x 100mm), FiberRunner, YL	piece	1	5
FRFWC6X4YL	Fitting, 4-Way Cross, 6” x 4” (150mm x 100mm), FiberRunner, YL	piece	1	5
FRFWCSC6YL	Split Cover, 4-Way Cross, 6” x 4” (150mm x 100mm), FiberRunner, YL	piece	1	5
FRH456X4YL	Fitting, Horizontal 45o Angle, 6” x 4” (150mm x 100mm), FiberRunner, YL	piece	1	5
FRH45SC6YL	Split Cover, Horizontal 45o, 6” x 4” (150mm x 100mm), FiberRunner, YL	piece	1	5
FRIV456X4YL	Fitting and Cover, Inside Vertical 45o, 6” x 4” (150mm x 100mm) FiberRunner, YL	piece	1	5
FRIVRA6X4YL	Fitting and Cover, Inside Vertical 90o, 6” x 4” (150mm x 100mm) FiberRunner, YL	piece	1	5
FROV456X4YL	Fitting, Outside Vertical 45o, 6” x 4” (150mm x 100mm), FiberRunner, YL	piece	1	5
FROV45SC6YL	Split Cover, Outside Vert 45o, 6” x 4” (150mm x 100mm), FiberRunner, YL	piece	1	5

Part number	Description	Unit of measure	Std. Pkg. Qty	Std. Ctn. Qty.
FROVRA6X4YL	Fitting, Outside Vertical 90o, 6” x 4” (150mm x 100mm), FiberRunner, YL	piece	1	5
FROVRASC6YL	Split Cover, Outside Vertical 90o, 6” x 4” (150mm x 100mm), FiberRunner, YL	piece	1	5
FRRA6X4YL	Fitting, Horizontal Right Angle, 6” x 4” (150mm x 100mm), FiberRunner, YL	piece	1	5
FRRASC6YL	Split Cover, Horizontal Right Angle, 6” x 4” (150mm x 100mm), FiberRunner, YL	piece	1	5
FRT6X4YL	Fitting, Horizontal Tee, 6” x 4” (150mm x 100mm), FiberRunner, YL	piece	1	5
FRTSC6YL	Split Cover, Horizontal Tee, 6” x 4” (150mm x 100mm), FiberRunner, YL	piece	1	5
FRRF64YL	Fitting and Cover, Reducer From 6” x 4” FiberRunner to 4” x 4” Fiber-Duct, YL	piece	1	5
FRADC6X4YL	Fitting, Adapter from 6” x 4” FiberRunner to 6” x 4” ADC FiberGuide, YL	piece	1	5
FRSPJ2X2YL	Spill-Over Junction Fitting with 2x2 Exit	piece	1	--
FRSPJC26YL	Spill-Over Junction with 2x2 Exit Cover, 6x4 Channel	piece	1	5
FRVT6X4YL	Fitting, Vertical Tee With Hinged Door, 6” x 4” (150mm x 100mm) FiberRunner, YL	piece	1	5
FIDT4X4BL	Fitting, 2-Port Spillout to 1.5” (38mm) Inside Diameter Corrugated Tubing, BL	piece	1	5
FTR4X4YL	Fitting, 3-Sided Vertical Tee Trumpet Spillout, YL	piece	1	5
F2PCLB58	Bracket, 2-Piece Ladder Rack Bracket / 5/8” Threaded Rod	piece	1	10
FR6TRBN58	Bracket, New 5/8” Thr. Rod QuikLock for 4” x 4” & 6” x 4” FiberRunner	piece	1	10
FRTBWG12BL	FiberRunner Threaded Rod Trapeze Bracket for Wyr-Grid 12” Width	piece	1	10
JP75W-L20	J-Hook - 3/4” capacity. One 1/4” hole for wall mount applications.	piece	50	--
JP75DW-L20	J-Hook - 3/4” capacity. Suitable for drop wire and threaded rod applications.	piece	50	--
JP131W-L20	J-Hook - 1.31” capacity. One 1/4” hole for wall mount applications.	piece	50	--

Part number	Description	Unit of measure	Std. Pkg. Qty	Std. Ctn. Qty.
JP131DW-L20	J-Hook - 1.31” capacity. Suitable for drop wire and threaded rod applications.	piece	50	--
JP2W-L20	J-Hook - 2” capacity. One 1/4” hole for wall mount applications.	piece	50	--
JP2DW-L20	J-Hook - 2” capacity. Suitable for drop wire and threaded rod applications.	piece	50	--
JP2SBC50RB-L20	J-Hook - 2” capacity with screw-on beam clamp suitable for flange up to 1/2” thick	piece	50	--
JP2HBC25RB-L20	J-Hook - 2” capacity with hammer-on beam clamp suitable for flange up to 1/2” thick	piece	50	--
JP2CMB-L20	J-Hook - 2” capacity with ceiling mount bracket. Includes 3/16”, 1/4”, and 3/8” mounting holes.	piece	50	--
JP4W-X20	J-Hook - 4” capacity. One 1/4” hole for wall mount applications.	piece	10	--

PART 3 EXECUTION

3.01 GENERAL

A. The Contractor shall perform the installation in accordance with the following guidelines:

1. Provide any necessary screws, anchors, clamps, tie wraps, distribution rings, miscellaneous grounding and support hardware, etc. necessary to facilitate the installation of the communications pathway system.
2. Furnish any special installation equipment or tools necessary to properly complete the installation.
3. Failure to follow the appropriate guidelines may require the installer to provide additional material and labor required to bring the installation back into alignment with the guidelines and to correct any and all damage to the cables caused by the installer during the implementation.
4. Provide fire blocking at all fire-rated ceiling, wall, and floor penetrations.
5. Plug conduits where cabling has been installed in the main equipment room, backbone, and other cable entrance locations with re-enterable duct seal of flame-retardant putty.
6. Provide bushings on all conduit ends.
7. All wiring, materials, and equipment must be listed and labeled by an NRTL. To certify performance characteristics that meet ANSI/TIA 568 Standards, provide all Original Equipment Manufacturer (OEM) documentation to the Owner.
8. All techniques and fixtures used in the installation must allow for easy maintenance of, and ready access to, all components for test measurements.
9. No self-tapping screws shall be used.
10. All parts shall be made of corrosion-resistant material, such as plastic, anodized aluminum, or brass.
11. All materials used in the installation shall be resistant to fungus growth and moisture deterioration.
12. To avoid corrosion caused by electrolysis between dissimilar metals under the environmental operating conditions specified, separate dissimilar metals with an inert dielectric material.
13. All cable runs must be continuous from patch panel to the outlet location.
14. All empty innerduct or conduit shall include a non-corrosive pull-rope.

15. All of the pathways shown on the drawings are suggested routes for the Contractor to use as guidelines. Prior to construction, the Contractor shall coordinate in the field with other trades to determine the exact feeder, tie, and riser backbone cabling pathways. In any case where the communication pathway must be removed and re-routed, due to conflicts with other trades with which the Contractor did not previously coordinate, the Contractor is responsible for all costs associated with the removal and relocation.
16. Upon completion of work, a Registered Communications Distribution Designer (RCDD) shall submit as-built drawings to the Owner and Engineer. The Contractor shall input the cabling data into the cable management software.

3.02 NON-CONTINUOUS CABLE SUPPORTS

A. The use of non-continuous cable supports as a primary pathway is not permitted.

B. Non-continuous cable supports shall be used to support horizontal cables from the point of their exit from the main pathway (wire basket or cable tray) to the point of termination.

C. Follow the manufacturer's recommendations for allowable fill capacity for each size of non-continuous cable support.

D. Installation and configuration of non-continuous cable supports shall conform to the requirements of the ANSI/TIA Standards 568-C and 569-D-1, NFPA 70 (National Electrical Code), and applicable local codes.

E. Non-continuous cable supports shall be placed straight, following building lines on 48 inch to 60 inch (1200 mm to 1500 mm) centers.

F. Non-continuous cable supports shall be installed every 48 to 60 inches, with a maximum sag of 6 inches.

G. At no point shall cables rest on acoustic ceiling grids or panels.

H. Non-continuous cable supports shall be attached to walls, purlins, beams, threaded-rod, or other components in strict compliance with all manufacturer Instructions and as directed by the Authority Having Jurisdiction (AHJ).

3.03 FIBER RUNNER – NON-METALLIC CABLING DUCT

A. Coordinate the installation of the fiber optic cable pathway with all other work as required to properly interface installation of this pathway with cabinets, racks, etc.

B. In spaces through which fiber optic cable pathway is run, provide sufficient space to install and maintain cables.

C. Cut all fiber optic cable pathway using a miter box and saw. For clean, burr-free cuts, cut larger quantities with a plastic cutting saw blade. A carbide 80T or 100T blade, .090 thick, with a 0.125 inch kerf is recommended.

D. Install the fiber optic cable pathway in accordance with recognized industry practices per UL 2024A, to ensure that the system complies with the requirements of the UL / ULC standards that pertain to Optical Fiber Cable Routing Assemblies for Riser.

3.04 WYRGRID – OVERHEAD CABLE TRAY

A. Install cable tray as indicated, in accordance with recognized industry practices (NEMA VE-2 2000), to ensure that the cable tray equipment complies with requirements of NEC, and applicable portions of NFPA 70B and NECA "Standards of Installation" pertaining to general

electrical installation practices.

B. Coordinate the installation of cable tray with other electrical work as required to properly interface cable tray installation with other work.

C. Install cable trays as a complete system, including fasteners, hold-down clips, support systems, splice connectors, elbows, tees, crosses, cable dropouts, adapters, and bonding.

D. Install cable trays so that the tray is accessible for cable installation and all splices are accessible for inspection and adjustment.

E. Remove burrs and sharp edges from cable trays.

F. Fasten cable tray supports to building structure.

G. Place supports so that the spans do not exceed the maximum indicated on the schedules, and provide the clearances shown on the Drawings. Install intermediate supports when cable weight exceeds the load-carrying capacity of the tray rungs.

H. Construct supports from channel members, threaded rods, and other appurtenances furnished by the cable tray manufacturer. Arrange supports in trapeze or wall-bracket form, as required by the application.

I. Locate and install supports according to NEMA VE 2. Do not install more than one cable tray splice between supports.

J. Support wire-mesh cable trays with trapeze hangers and wall brackets.

K. Support trapeze hangers for wire-mesh trays with 1/2-inch (13 mm) diameter rods.

L. Make changes in direction and elevation using the manufacturer’s recommended fittings.

M. Make cable tray connections using the manufacturer’s recommended fittings.

N. Seal penetrations through fire and smoke barriers, in compliance with the requirements set forth by the Authority Having Jurisdiction (AHJ).

O. Install cable trays with enough workspace to permit access for installing cables.

P. After installing the cable tray, install warning signs in visible locations on or near cable trays.

Q. Test wire basket support systems to ensure the electrical continuity of bonding and grounding connections and to demonstrate compliance with the specified maximum grounding resistance. For testing and test methods, see NFPA 70B, Chapter 18.

3.05 TELECOMMUNICATIONS PATHWAY GROUNDING

A. Ground all metallic pathways according to NFPA 70, and provide additional grounding as specified In ANSI/TIA-607-C-1.

B. Bond communications cable pathways together with splice connectors.

C. Bond control conductor pathways with splice connectors.

D. When using splice connectors, the Contractor shall ensure electrical continuity between

pathway sections by tightening the integrated thread cutting screw until it pierces the paint of the adjacent pathway sections to create a completely bonded connection.

E. Have a tradesperson licensed by the Authority Having Jurisdiction (AHJ) bond all pathways by means of an appropriate “C” type tap, using a minimum #1 AWG tap conductor, to the electrical service earth at the nearest panel board.

3.06 CABLE INSTALLATION

A. Install cables only after each cable tray run has been completed and inspected.

B. Fasten cables on horizontal runs with hook and loop tape in accordance with NEMA VE Tighten the tape only enough to secure the cable, without indenting the cable jacket.

C. Fasten cables on vertical runs to pathways every 18 inches (450 mm).

D. Fasten and support cables that pass from one pathway to another or drop from cable trays to equipment enclosures. Fasten cables to the pathway at the point of exit, and support cables independent from the enclosure. The length of the cable between pathways or between cable tray and enclosure shall be no more than 72 inches (1800 mm).

E. Remove all inactive and abandoned cables, as required by NFPA 70.

3.07 FIELD QUALITY CONTROL

A. Perform the following tests and inspections.

1. After installing pathways and after electrical circuitry has been energized, survey for compliance with requirements.
2. Visually inspect cable insulation for damage. Correct sharp corners, protuberances in pathways, vibrations, and thermal expansion and contraction conditions that may cause or may have already caused damage.
3. Verify that the number, size, and voltage of cables in the pathways do not exceed that permitted by NFPA 70. Verify that communications or data-processing circuits are separated from power circuits by barriers or are installed in separate pathways.
4. Verify that no items such as pipes, hangers, or other equipment intrude into the pathway.
5. Remove all dust deposits, industrial process materials, trash, and anything else that might block tray ventilation.
6. Visually inspect each pathway joint and each ground connection for mechanical continuity. Check bolted connections between sections for corrosion. Clean and re torque areas any areas that appear to have issues.
7. Ensure that all bonding screws have been secured on all splice connectors.
8. Check for missing, incorrect, or damaged bolts, bolt heads, or nuts. If any are found, replace them with the specified hardware.
9. Perform visual and mechanical checks of pathway grounding. Verify that all takeoff raceways are bonded to cable trays. Test the entire pathway system for continuity. The maximum allowable resistance is 1 ohm.

B. Prepare test and inspection reports.

C. During construction, to protect exposed cables in open trays from falling objects or debris, install temporary protection constructed of wood or metal and keep this protection in place until there is no longer risk of damage.

END OF SECTION

SECTION 27 0553

IDENTIFICATION FOR COMMUNICATIONS SYSTEMS

PART 1 GENERAL

1.01 SUMMARY

A. What This Section Includes

1. This Section includes the specifications for:

   a. The supply, delivery, supervision, coordination, and installation of equipment items specified herein and shown on drawings
   b. The specifications for the incorporation of Owner Furnished Equipment (OFE)
   c. The documentation and instruction for completing the Identification for Communication Systems

B. Related Drawings

1. T-Series drawings follow the specifications in this Section.
2. Electrical drawings specify the electrical requirements.
3. Interior Design drawings specify interior finishes, spatial relationships between items, and specific mounting height.

C. What the Contractor Shall Provide and Install

1. Although such work is not specifically mentioned herein or on the drawings, the Contractor shall furnish and install all miscellaneous items, accessories, appurtenances, and devices incidental to or required for a sound, secure, and complete installation, without claim for additional payment.

D. Errors or Omissions in Drawings or Documentation

1. If any errors or omissions appear in Drawings, Specifications, or other documents, the bidding Contractor shall notify the Engineer no later than ten (10) days prior to submitting bid.
2. Should conflict occur in or between drawings and specifications, the bidding Contractor is deemed to have estimated the more expensive way of doing the work, unless the bidding Contractor has asked for and obtained a written decision (addendum), before submission of the bid, as to which method or materials will be required.

E. Dimensions

1. Dimensions indicated are limiting dimensions.

   a. Do not use equipment exceeding dimensions indicated.
   b. Do not use equipment or arrangements that reduce required clearances or exceed specified maximum dimensions.

1.02 REFERENCES

A. Requirements, Codes, and Standards

1. Design, manufacture, test, and install telecommunications cabling networks per manufacturer's requirements and in accordance with latest revision of the NFPA-70 (National Electrical Code®), state codes, local codes, requirements of Authorities Having Jurisdiction (AHJ), and the following standards, including the most current revisions, addendums, and any Technical Service Bulletins (TSBs) that may have been released at the time of bid, including:

a. ANSI/TIA-606-C – Administration Standard for Commercial Telecommunications Infrastructure

B. BICSI® Publications

1. Install cabling in accordance with the most recent edition of BICSI® publications:

a. BICSI – Telecommunications Distribution Methods Manual, Current Edition
b. BICSI – Information Technology Systems Installation Manual, Current Edition
c. BICSI – Outside Plant Design Reference Manual, Current Edition

C. Applicability of Codes, Rules, and Regulations

1. Federal, state, and local codes, rules, regulations, and ordinances governing the work are as fully part of the specifications as if herein repeated or hereto attached.
2. If the contractor should note items in the drawings or the specifications, construction of which would be code violations, the Contractor should promptly call them to the attention of the Owner's representative in writing.
3. Where the requirements of other sections of the specifications are more stringent than the applicable codes, rules, regulations, and ordinances, the specifications shall apply.

D. Definitions

1. The following are the definitions of the terms used in this Section:

a. AWG – American Wire Gauge – The standardized system for gauging the diameter of round, solid, non-ferrous, electrically-conducting wire.
b. BBC – Bonding Backbone Conductor – A telecommunication bonding connection which interconnects telecommunications bonding backbones. Formerly known as the grounding equalizer.
c. BD – Building Distributor – A distributor in which the building backbone cables terminate and at which connections to the campus backbone cables may be made.
d. BN – Bonding Network – A set of interconnected conductive structures that provides a low impedance path for the associated telecommunications infrastructure.
e. CP – Consolidation Point – A connection facility within Cabling Subsystem 1 for interconnection of cables extending from building pathways to the equipment outlet.
f. EDA – Equipment Distribution Area – A space allocated for end equipment, including computer systems and telecommunications equipment.
g. EF – Entrance Facility – An entrance to a building for both public and private network service cables, including wireless that includes the entrance point of the building and continues to the entrance room or space.
h. ER – Equipment Room – A centralized space for telecommunications equipment that serves the occupants of the building, distinct from a Telecommunications Room (TR) because of the nature or complexity of the equipment.
i. ESD – Electro Static Discharge – The sudden flow of electricity between two electrically-charged objects caused by contact, an electrical short, or dielectric breakdown.
j. HC – Horizontal Cross-connect – A group of connectors, such as patch panels or punch-down blocks, that allow horizontal, backbone, and equipment cabling to be cross-connected with patch cords or jumpers.
k. HDA – Horizontal Distribution Area – A space in a computer room where a Horizontal Cross-connect (HC) is located and which may include LAN switches, Storage Area Network (SAN) switches, and Keyboard/Video/Mouse (KVM) switches for the end equipment located in the equipment distribution areas.
l. IC – Intermediate Cross-connect – A facility enabling the termination of different levels of backbone cabling and interconnection between them or equipment.

m. MC – Main Cross-connect – A facility enabling the termination of backbone cables and their connection to incoming services, other backbone cabling, or equipment
n. MDA – Main Distribution Area – The central point of distribution for the structured cabling system, which includes the Main Cross-connect (MC) and, when equipment areas are served directly from the MDA, may also include Horizontal Cross-connect (HC).
o. Mesh-BN – Mesh Bonding Network – A bonding network to which all associated equipment, such as cabinets, frames, racks, trays, and pathways, are connected using a bonding grid that is connected to multiple points on the common bonding network.
p. PBB – Primary Bonding Busbar – A busbar placed in a convenient and accessible location and bonded, by means of the Telecommunications Bonding Conductor (TBC), to the buildings service equipment (power) ground. Formerly known as the Telecommunications Main Grounding Busbar (TMGB).
q. RBB – Rack Bonding Busbar – A busbar within a cabinet, frame, or rack.
r. RBC – Rack Bonding Conductor – A bonding conductor from the rack or Rack Bonding Busbar (RBB) to the Telecommunications Equipment Bonding Conductor (TEBC).
s. RU – Rack Unit – A unit of measure, compliant with EIA 310, used to describe the height of equipment intended for mounting on equipment rails. One RU is 1.75 inches (44.45 mm) high.
t. SBB – Secondary Bonding Busbar – A common point of connection for telecommunications system and equipment bonding to ground, located in the distributor room. Formerly known as the Telecommunications Grounding Busbar (TGB).
u. SE – Service Entrance – The room or space inside a building where telecommunications cables enter and leave the building.
v. TBB – Telecommunications Bonding Backbone – The conductor that interconnects the Primary Bonding Busbar (PBB) to the Secondary Bonding Busbar (SBB).
w. TBC – Telecommunications Bonding Conductor – A conductor that interconnects the telecommunications bonding infrastructure to the building's service equipment (power) ground. Formerly known as the bonding conductor for telecommunications.
x. TEBC – Telecommunications Equipment Bonding Conductor – A conductor that connects the primary
y. TO – Telecommunications Outlet – A connecting device, located in a work area, at which the horizontal cabling terminates.
z. TR – Telecommunications Room – An enclosed space for housing telecommunications equipment, cable terminations, and cross-connect cabling. It is the recognized location of the cross-connect between the backbone and horizontal facilities.
aa. UBC – Unit Bonding Conductor – A bonding conductor from equipment or a patch panel to a rack bonding conductor or a rack bonding busbar.
bb. ZDA – Zone Distribution Area – A space where a zone outlet or consolidation point is located, between the horizontal and equipment distribution areas, that allows frequent reconfiguration and flexibility.

1.03 SYSTEM DESCRIPTION

A. The Contractor will provide and install identification labeling for the project’s voice and data communications systems, including all components from the TO to the TR and between telecommunications spaces.

1.04 DELIVERY, STORAGE, AND HANDLING

A. Handling

1. To prevent damage, theft, soiling, and misalignment, protect equipment during transit, storage, and handling.

B. Storage

1. The Contractor shall coordinate secure storage of equipment and materials onsite or, if no on-site storage is available, shall provide their own secure storage at the Contractor's expense.

a. Do not store equipment where conditions fall outside manufacturer's recommendations for environmental conditions.
b. Do not install damaged equipment. Remove damaged equipment from the site, and replace it with new equipment.
c. If off-site storage of materials is necessary, this shall be at the Contractor's expense.

1.05 COORDINATION

A. Installation Schedule

1. The Contractor shall coordinate with all other trades. The Contractor will submit a schedule for the installation within 10 days of contract award.

a. The schedule shall include delivery, installation, and testing for conformance to specific job completion dates.
b. At a minimum, dates are to be provided for the start of demolition, the completion of demolition, the installation start date, the completion of horizontal cabling, the completion of riser cabling, the completion of testing and labeling, cutover, the completion of the final punch list, final inspection, and acceptance.

B. Meeting Attendance and Schedule Adherence

1. The Contractor must attend all project-related meetings and adhere to the schedule set by the Project Manager.

C. Final Inspection

1. The Contractor is required to notify the Engineer of a proposed appointment for Final Inspection at least 72 hours before the appointment.
2. Within five working days after the final inspection, the Contractor shall send final project documentation and warranty information to the Owner and Engineer. The final project documentation shall include, but may not be limited to:

a. As-Built Drawings, in AutoCAD format, with legible outlet address and cable paths
b. Outlet location spreadsheets
c. Warranty paperwork
d. A copy of the Final Inspection and Acceptance Signoff Sheet
e. Photos of each ER and TR

1.06 PROJECT CONDITIONS

A. Project Environmental Requirements

1. Optical Fiber Cable Safety

a. The following warnings shall be posted on the job site:

1) WARNING: PERMANENT EYE DAMAGE CAN RESULT FROM LOOKING DIRECTLY INTO A LIGHT BEAM GENERATED BY AN LED OR LASER SOURCE OR INTO THE END OF A CABLE FIBER CONNECTED TO ONE OR THESE SOURCES.

2) CAUTION: LIGHT GENERATED BY THESE SOURCES MAY NOT BE VISIBLE, YET REMAIN HAZARDOUS TO THE EYE. LOOK FOR WARNING LABELS ON SOURCE DEVICES.

b. Observe all warning signs on equipment and all written safety precautions in instruction and technical manuals.

c. Always handle cable carefully to avoid personal injury. Care should be taken with individual fibers to prevent injury to the eyes or penetration of the fibers into the skin.

2. Hazardous Materials Prohibition

a. The Contractor shall ensure that all materials used in the project are asbestos-free, unless specifically authorized in writing by the Owner.

b. Applicable products shall comply with the European directives on the Restriction of Hazardous Substances (RoHS; 2002/95/EC) and Waste Electrical and Electronic Equipment (WEEE; 2002/96/EC).

B. Existing Conditions

1. Verify that all conditions on the project site applicable to the Work specified in this Section are as documented and are appropriate for the Work. Prior to bid opening, notify the Consulting Engineer in writing of any discrepancies, conflicts, or omissions. Otherwise, correct these at no additional cost to the Owner.
2. Continue to monitor the project site. If conditions develop that require a variance from the Specifications or Drawings, then immediately notify the Owner in writing. Otherwise, make recommendations, submit drawings showing how the Work may be installed, and upon approval, proceed with the necessary changes without additional cost to the Owner.

C. Record Drawings:

1. Keep a complete set of all telecommunications drawings in the job site office for demonstration of actual installation of work under this Section.
2. Use this set of drawings for no other purpose.
3. When any material, equipment, or system components are installed differently than what is shown on the drawings, indicate differences clearly and neatly using ink or indelible pencil.
4. Upon completion of the project, submit record set of drawings.

1.07 USE OF THE SITE

A. Where the Owner deems it necessary to place restrictions, use the site as directed by the Owner.

B. When proceeding with the work, do not interfere with the ordinary use of streets, aisles, passages, exits, or operations of the Owner. During the day, set up cones and barriers in hallways and walkways. Do not string cable down the hallways during normal hours.

C. Request a hazardous materials worksheet that identifies potential-hazardous locations. Do not proceed with any work in locations where hazardous materials are known to be. Obtain instructions from the Contractor’s Project Manager on how and when to work in these areas.

D. Multiple times each day, each contractor shall remove all trash and debris from the site.

E. Before leaving the room each day:

1. Contractor shall replace all ceiling tiles that they have removed.

2. The Contractor shall place all furniture and equipment that they have moved back into its original location.
3. The Contractor shall return any equipment that they have disconnected to working order.
4. The Contractor's Job Foreman shall inspect all work locations to ensure that the rooms are clean and that all of the tasks described above have been done.
5. It is recommended that the Contractor inspect the site and take pictures to document the condition of the ceilings and walls.

1.08 CONTINUITY OF SERVICES

A. Take no action that will interfere with or interrupt the existing building services unless previous arrangements have been made with the Owner's representative. Arrange all work to minimize shutdown time.

B. The Owner's personnel shall perform shutdown of operating systems. When shutdown of systems is required, the contractor shall give three (3) days' advance notice.

C. Should building services be inadvertently interrupted:

1. The Job Foreman shall immediately notify the Project Manager of the accidental disruption of services, the remedy, and how long it will take to restore services.
2. The Contractor shall immediately furnish the labor, including overtime, the material, and the equipment necessary to promptly restore the interrupted service at no cost to the Owner.

1.09 WARRANTY

A. The Contractor shall provide the following warranties for the system and components.

1. Contractor Materials and Labor Warranty

a. The Contractor shall provide system warranties, for a period specified in the contract documents, against faulty materials and defects in workmanship. The Contractor shall also honor any manufacturer warranties that exceed this period time.

2. Manufacturer Component Warranty

a. All components of the identification system shall be free from manufacturing defects in material or workmanship, under normal and proper usage, for a minimum of one (1) year.

B. The Manufacturer shall bear the burden to replace or repair any defective products during the warranty period at their cost, including labor and materials.

C. The warranty period shall begin on the date of the Owner's Acceptance of the Work. Evaluation of quality and workmanship shall be solely by the Owner or the Owner representatives.

PART 2 PRODUCTS

2.01 GENERAL

A. In this section, certain products are specified by manufacturer and part number to establish a level of quality, performance, and consistency. To substitute other products would defeat this effort to the Owner's detriment. If no manufacturer or part number is specified for a part, then that part is generic, and the Contractor shall submit for approval a part that provides the performance specified herein.

B. All products specified in this section, shall be manufactured by Panduit. Owner Furnished

Equipment (OFE) and materials shall be appropriate for the intended use and shall be recognized as such by a Nationally Recognized Testing Laboratory (NRTL), such as Underwriters Laboratories (UL), ETL SEMCO (ETL), the Canadian Standards Association (CSA), or the American National Standards Institute (ANSI).

C. All products shall be new, of the latest version at time of bid, and brought to the job site in original manufacturer's packaging. Electrical components shall bear the UL or ETL label, and this listing requirement shall apply to the entire assembly. Only systems and equipment that meet or exceed the level of quality and the capabilities stated within this document will be considered for acceptance. Used equipment or damaged material will be rejected.

D. Any modifications to equipment to suit the intent of the specifications shall be performed in accordance with these requirements.

E. Take care during installation to prevent scratches, dents, chips, etc. Equipment with significant or disfiguring cosmetic flaws will be rejected.

F. All components will be approved by the Engineer and shall have the highest aesthetic value possible while providing the specified functionality. Hardware shall:

1. Be in compliance with the Construction Documents
2. Have fit and finish compatible with the existing surrounding structure
3. Be unobtrusive
4. Provide the required functionality

G. Provide products that are suitable for the intended use, for the environment in which they are to be installed, that meet regulatory requirements, and that comply with applicable electrical codes.

2.02 IDENTIFICATION

A. Labels

1. Label Construction

a. Labels shall be white, manufactured of resilient and flexible vinyl or polyester, die-cut, and have adhesive backing for permanent attachment.

2. Labels for Data Cables

a. Labels for data cables shall be:

1) Self-laminating
2) Rotatable/repositionable
3) Of appropriate size to completely encircle the cable and completely overlay the identification tag area

3. Placement of Data Cable Labels

a. Labels shall be placed within view at the termination points, within 3 inches (75 mm) of each end of each:

1) Backbone cable
2) Horizontal cable
3) Bonding conductor

4. Labels for Data Cable Bundles

a. Cable bundles shall be identified with non-adhesive thermal-transfer-printable marker plates.
b. Marker plates shall be attached to cable bundles with nylon cable ties or hook and

loop ties.

c. Marker plates shall offer legends and shall meet the requirements of MIL-STD-202G, Notice 12 Method 215J (Thermal Transfer Printable Marker Plates).

5. Labels for Cabinets and Equipment

a. Cabinets and equipment shall be identified with thermal-transfer-printed, die-cut, microcellular foam labels with a polyester printable surface and high-tack adhesive.
b. Each outlet, patch panel, and wiring block shall be identified by a label installed on or in the space provided on the device.

6. Label Sizes for Outlets and Termination Hardware

a. Labels for outlets and termination hardware shall be at least 1-1/4 inches wide and 3/8 inch high.

7. Label Sizes for Other Equipment

a. Labels for the following shall be at least 4 inches wide and 1 inch high:

1) Riser cables
2) Network equipment
3) Equipment cabinets and racks
4) Bonding busbars
5) Consolidation point enclosures
6) Active hardware and equipment

B. Warning Tags

1. At each location where the fiber cable is exposed to human intrusion, it shall be marked with warning tags. These tags shall:

a. Be yellow or orange
b. Bear the warning, “CAUTION FIBER OPTIC CABLE”
c. Have this text in permanent, black, block characters at least 5 mm high

2. A warning tag shall be permanently affixed to each exposed cable or bundle of cables at intervals of not less than 1.5 m.
3. Any section of exposed cable less than 1.5 m long shall have at least one warning tag affixed to it.

C. Printing of Labels

1. Printing shall be machine-generated in permanent ink that contrasts the background color.
2. All characters shall be block style.
3. The text shall fill the area of the printable field.

Part number	Description	Unit of measure	Std. Pkg. Qty	Std. Ctn. Qty.
LS8EQ-KIT	QWERTY LS8EQ, Printer Kit	kit	1	1
TDP43ME-KIT	Desktop Printer Kit	kit	1	1
PTR-CLN	Printer cleaning kit -- contains (1) cleaning pen, (8) cleaning solution soaked wipes, (8) foam swabs pre-	kit	1	--

Part number	Description	Unit of measure	Std. Pkg. Qty	Std. Ctn. Qty.
	saturated with cleaning solution, MSDS, and cleaning instructions.			
LJSL5-Y3-2.5	Laser/Ink Jet, Self-Lam Label, Adhesive Polyester, 1.00” W x 1.33” H, .47” POA, Clear/White, 52 per pk	piece	1	10
NWSLC-2Y	Yellow cable identification sleeve for 2mm simplex fiber cable, 1” Length, 100 per pack	piece	100	1000
R100X125V1T	Therm Trans, Turn-Tell, Vinyl, 1.00” W X 1.25” H, 0.38” POA, Clear/White, 3” Core	piece	2500	10000
R100X125V1C	Cassette, Vinyl, 1.00” W X 1.25” H, 0.38”, Clear/White, 3” Core	piece	1	10
S100X150YAJ	Laser/Inkjet, Self-Lam Label, Polyester, 1.00” W x 1.50” L, .50” POA, Clear/White	piece	1	10
S100X150VAC	P1 Cassette, Self-Lam Label, Vinyl, 1.00” W x 1.50” H, .50” POA, Clear/White	piece	1	10
S100X150VATY	ThermTrans, Self-Lam Label, Vinyl, 1.00” W x 1.50” H, .50” POA, Clear/White, 3” core	piece	5000	--
C125X030YPT	Thermal transfer component label, 1.25” W x 0.30” H, 2-port, super-tack polyester, white, 3 labels/row, 2500 per pack	piece	2500	10000
C125X030FJC	Network label, P1 cassette, 1.25” W x 0.30” H, polyolefin, white, 200 labels/cassette, 1 pc. package quantity.	piece	1	10
C252X030YPT	Thermal transfer component label, 2.52” W x 0.30” H, super-tack polyester, white, 1 label/row, 2500 pc. package quantity.	piece	2500	10000
C252X030FJC	Network label, P1 cassette, 2.52” W x 0.30” H, polyolefin, white, 125 labels/cassette, 1 pc. package quantity.	piece		
EMPLUS-2GO	Easy-Mark Labeling Software	piece	1	--
PROG-EM2GO	Easy-Mark Labeling Software - USB flash drive	piece	1	--

PART 3 EXECUTION

3.01 GENERAL

A. Upon completion of work, a Registered Communications Distribution Designer (RCDD) shall submit as-built drawings to the Owner and Engineer, and the Contractor shall input the cabling data into the cable management software.

B. Provide any necessary screws, anchors, clamps, tie wraps, support hardware, etc. necessary

to facilitate the installation of the identification communication system.

C. Furnish any special installation equipment or tools necessary to properly complete the installation.

D. Failure to follow the appropriate guidelines may require the installer to provide additional material and labor required to bring the installation back into alignment with the guidelines and to correct any and all damage to the cables by the installer during the implementation.

E. All techniques and fixtures used in the installation must allow for easy maintenance of, and ready access to, all components for test measurements.

F. No self-tapping screws shall be used.

G. All parts shall be made of corrosion resistant material, such as plastic, anodized aluminum or brass.

H. All materials used in installation shall be resistant to fungus growth and moisture deterioration.

I. To avoid corrosion caused by electrolysis between dissimilar metals under the environmental operating conditions specified, separate dissimilar metals with an inert dielectric material.

3.02 SYSTEM ADMINISTRATION

A. All components of the installed system shall be uniquely identified by location, function, unit, and sub-unit.

B. Each location shall be identified by a unique alphanumeric identifier.

C. Each equipment enclosure in the building shall be assigned a unique alphanumeric identifier.

D. Each adapter module installed in each distribution or interconnect enclosure shall be identified by an alphanumeric identifier.

E. All conduits, trays, and pathways shall be identified by a unique alphanumeric identifier.

F. Optical fiber cables shall be identified by a textual label, which indicates its type, strand count, point of origin, and termination.

G. Supply a Cable Identification Matrix.

H. Supply all records in compliance with ANSI/TIA-606-C.

I. Provide a database, compliant with Open Database Connectivity (ODBC), for administration of the Structured Cabling System described herein.

3.03 IDENTIFICATION

A. Prior to the installation or termination of cabling, confirm all specific labeling requirements with the Owner or the Owner’s Engineer.

B. Cables

1. Mark backbone cables at each endpoint and at all intermediate pull points, access points, and junction boxes. Labels shall indicate the origination and destination identifier, the sheath identifier, and the strand or pair range.

2. Horizontal cables shall be marked at each end, on the sheath indicating the TR, patch panel and panel port to which the cable is wired. Block terminated cable shall be identified with a V in place of the panel ID.

C. Faceplates, Patch Panels, and Wiring Blocks

1. Mark Fiber Distribution Enclosures (FDEs) with adhesive labels that indicate the range of circuits installed within. Label each port with the origination and destination grid identifier and the individual strand ID.
2. Label patch panels alphabetically, beginning at the top. Individual ports shall come from the factory labeled with a number designation.
3. Label each faceplate to indicate, for each cable that it houses, the TR, patch panel, and panel port to which the cable is wired. Label block-terminated cables with the Telecommunication Room and “V” cable number.
4. Label each wiring block numerically, beginning at the top left of the termination field. Within each block, identify the individual rows alphabetically, beginning at the top left and proceeding sequentially down and to the right. Label each row with the corresponding cable identifier, and label each pair or circuit on each cable.
5. Fit each cable with a self-laminating label, bearing the appropriate cable identifier that surrounds the outermost jacket. Place the label at each end of the cable, within 3 inches (75 mm) of the end of the sheath.
6. Fit each equipment enclosure with a self-adhesive label bearing its respective identifier, affixed to the top center of the front and rear doors.
7. Fit each FDE with a self-adhesive label, bear its respective identifier in block characters, affixed at the top center of the front and rear faces.
8. Fit each adapter inside enclosures with a label bearing its identifier, affixed directly adjacent to its shortest side. Rotate characters so that their orientation is kept left to right, top to bottom.
9. Label conduits and pathways within 0.5 m (18 inches) of each end, where exposed and accessible. It is recommended that additional labeling be provided every 3 m (10 feet) of exposed length.
10. Fit network equipment with a label, placed in an accessible area on the front and rear, bearing the appropriate identifier, MAC address, and date of installation. The label shall not interfere with the operation of or interface to the unit, nor shall it obscure manufacturer’s labels.

END OF SECTION

SECTION 27 0800

COMMISSIONING OF COMMUNICATIONS

PART 1 GENERAL

1.01 SUMMARY

A. This Section includes the minimum requirements for the test certification, identification, and administration of horizontal balanced twisted pair cabling and backbone optical fiber cabling.

B. The Contractor shall provide all labor, materials, tools, field-test instruments and equipment required for the complete testing, identification and administration of the work called for in the Contract Documents.

C. In order to conform to the overall project event schedule, the cabling Contractor shall survey the work areas and coordinate cabling testing with other applicable trades.

D. In addition to the tests detailed in this document, the Contractor shall notify the Owner or the Owner's representative of any additional tests deemed necessary to guarantee a fully functional system. The Contractor shall carry out and record any additional measurement results at no additional charge.

1.02 SCOPE

A. This Section includes the minimum requirements for:

1. Identification, including labels and labeling
2. Administration, including:
    a. Test results documentation
    b. As-built drawings
3. The testing of copper cabling, including:
    a. Test instruments
    b. Test procedures
4. The testing of fiber optic cabling, including:
    a. Test instruments
    b. Test procedures

B. Testing shall be carried out in accordance with this document. The Contractor shall:

1. Test all installed balanced twisted pair cabling permanent links to the applicable performance level.
2. Test the attenuation and polarity of the installed optical fiber cable plant with an Optical Loss Test Set (OLTS)
3. Test the installed condition of the optical fiber cabling system and its components with an Optical Time Domain Reflectometer (OTDR)
4. Verify the condition of the fiber end faces

C. The Contractor shall document all tests including:

1. OLTS dual wavelength attenuation measurements
2. OTDR traces with event tables and OTDR maps
3. Optical length measurements and pictures of the connector end faces

1.03 REFERENCES

A. Requirements, Codes, and Standards

1. All testing procedures and field test instruments shall comply with the applicable requirements of the following standards including the most current revisions, addendums, and any Technical Service Bulletins (TSBs) released at the time of bid:

   a. ANSI Z136.2, ANS For Safe Use of Optical Fiber Communication Systems Utilizing Laser Diode and LED Sources
   b. ANSI/TIA-455-C, General Requirements for Standard Test Procedures for Optical Fibers, Cables, Transducers, Sensors, Connecting and Terminating Devices, and other Fiber Optic Components
   c. ANSI/TIA-526-7, Optical Power Loss Measurements of Installed Single-mode Fiber Cable Plant
   d. ANSI/TIA-526-14-B, Optical Power Loss Measurements of Installed Multimode Fiber Cable Plant; IEC 61280-4-1 edition 2, Fibre-Optic Communications Subsystem Test Procedure- Part 4-1: Installed cable plant- Multimode attenuation measurement
   e. TIA-TSB-4979 Practical Considerations for Implementation of Multimode Launch Conditions in the Field
   f. ANSI/TIA-1152, Requirements for Field Test Instruments and Measurements for Balanced Twisted-Pair Cabling
   g. ANSI/TIA-568-0. D, Generic Telecommunications Cabling for Customer Premises.
   h. ANSI/TIA-568-1. D, Commercial Building Telecommunications Cabling Standard
   i. ANSI/TIA 568 C.2, Balanced Twisted-Pair Telecommunications Cabling and Components Standards.
   j. ANSI/TIA 568 C.3, Optical Fiber Cabling Components Standard
   k. ANSI/TIA-606-C, Administration Standard for Telecommunications Infrastructure, including the requirements specified by the customer, unless the customer specifies their own labeling requirements.

B. Applicability of Codes, Rules, and Regulations

1. Federal, state, and local codes, rules, regulations, and ordinances governing the work, are as fully part of the specifications as if herein repeated or hereto attached.
2. If the Contractor notes items in the drawings or the specifications, construction of which would be code violations, the Contractor should promptly call them to the attention of the Owner's representative in writing.
3. Where the requirements of other sections of the specifications are more stringent than applicable codes, rules, regulations, and ordinances, the specifications shall apply.

C. Balanced Twisted Pair Testing

1. Trained technicians, who have successfully attended an appropriate training program and have obtained a certificate as proof thereof, shall execute the tests. Acceptable certificates are ones that have been issued by any of the following organizations or an equivalent organization:

   a. The manufacturer of the connectors and/or the cable
   b. The manufacturer of the test equipment used for the field certification
   c. Training organizations such as Building Industry Consulting Service International (BICSI), the Association of Cabling Professionals™ (ACP), the Cabling Business Institute (CBI)

D. Optical Fiber Testing

1. Trained technicians who have successfully attended an appropriate training program, which includes testing with an OLTS and an OTDR and have obtained a certificate as proof thereof shall execute the tests. These certificates may have been issued by any of the following organizations or an equivalent organization:

a. The manufacturer of the connectors and/or the cable
b. The manufacturer of the test equipment used for the field certification
c. Training organizations such as Building Industry Consulting Service International (BICSI), the Association of Cabling Professionals™ (ACP), the Cabling Business Institute (CBI)

E. Owner's Participation

1. The Owner or the Owner's representative shall be invited to witness and/or review field testing.
2. Five business days before testing commences, the Owner or the Owner's representative shall be notified of the start date of the testing phase.
3. The Owner or the Owner's representative shall:

a. Select a random sample of five percent of the installed links
b. Test these randomly-selected links
c. Store the results in accordance with Part 3 of this document

4. The Contractor shall compare the results obtained by the Owner to the data provided by the installation Contractor. If more than two percent of the pass/fail determinations in the sample results differ from the data provided by the installation Contractor, the Contractor, under the supervision of the Owner's representative, shall repeat one hundred percent of the testing at no cost to the Owner.

1.04 SUBMITTALS

A. The Contractor shall submit the following:

1. The manufacturer's catalog sheets and specifications for the test equipment
2. A schedule (list) of all links and channels to be tested
3. Sample test reports
4. The test equipment serial number
5. A graphic diagram documenting the test procedure, including all connectors, the light source (as applicable,) the origin, and the destination of each cable tested.

1.05 TEST RESULTS

A. Balanced Twisted Pair Links

1. Category 5E and Category 6 Balanced Twisted Pair

a. Unless otherwise specified by the Owner or the Owners representative, each Category 5E and Category 6 balanced twisted pair cabling link shall be tested for:

1) Wire Map
2) Length
3) Propagation Delay
4) Delay Skew
5) DC Loop Resistance
6) DC Resistance Unbalance within a pair
7) DC Resistance Unbalance between pairs
8) Insertion Loss
9) Near-End Crosstalk (NEXT)
10) Power Sum Near-End Crosstalk (PS NEXT)
11) Attenuation to Crosstalk Ratio Near-End (ACR-N)
12) Power Sum Attenuation to Crosstalk Ratio Near-End (PS ACR-N)
13) Attenuation to Crosstalk Ratio Far-End (ACR-F)
14) Power Sum Attenuation to Crosstalk Ratio Far-End (PS ACR-F)
15) Return Loss

16) Transverse Conversion Loss (TCL)
17) Equal Level Transverse Conversion Transfer Loss (ELTCTL)

2. Category 6A Balanced Twisted Pair

a. Unless otherwise specified by the Owner or the Owners representative, each Category 6A link shall be tested for all of the parameters listed above for Category 5E and Category 6 as well as the following additional parameters:

1) Power Sum Alien Near-End Crosstalk (PS ANEXT)
2) Average Power Sum Alien Near-End Crosstalk (Average PS ANEXT)
3) Power Sum Alien Attenuation to Crosstalk Ratio Far-End (PS AACR-F)
4) Average Power Sum Alien Attenuation to Crosstalk Ratio Far-End (Average PS AACR-F)

3. When a Balanced Twisted Pair Permanent Link Fails

a. All installed balanced twisted pair cabling permanent links shall be field-tested and shall pass the test requirements and analysis described in Part 3.

1) Any permanent link that fails these requirements shall be diagnosed and corrected.
2) Any corrective action that must take place shall be documented and followed with a new test to prove that the corrected permanent link meets performance requirements.
3) The final and passing result of the tests for all permanent links shall be provided in the test results documentation, in accordance with Part 3.

B. Optical Fiber Links

1. Test Limits

a. Unless otherwise specified by the Owner or the Owners representative, each optical fiber cabling link shall comply with the following test limits:

1) Optical loss testing
2) Multi-mode and single-mode links
3) Link attenuation calculated by the following formulas, as specified in ANSI/TIA-568-C.0:

a) Link Attenuation (dB)=Cable_Attn (dB)+Connector_Attn (dB)+Splice_Attn (dB)
b) Cable_Attn (dB) = Attenuation_Coefficient (dB/km)*Length (Km)
c) Connector_Attn(dB)=number_of_connector_pairs*connector loss (dB)
d) Maximum allowable connector loss=0.75 dB
e) Splice_Attn (dB)=number_of_splices*splice_loss (dB)
f) Maximum allowable splice_loss = 0.3 dB

4) The values for the Attenuation_Coefficient (dB/km) are listed in the table below.
5) Where application limits are more stringent, those shall apply.

Type of optical fiber	Wavelength (nm)	Attenuation Coefficient (db/km)	Wavelength (nm)	Attenuation Coefficient (db/km)
Multi-mode 62.5/125 µm	850	3.5	1300	1.5

Type of optical fiber	Wavelength (nm)	Attenuation Coefficient (db/km)	Wavelength (nm)	Attenuation Coefficient (db/km)
Multi-mode 50/125 µm	850	3.5	1300	1.5
Single-mode (Inside plant)	1310	1.0	1550	1.0
Single-mode (Outside plant)	1310	0.5	1550	0.5

2. OTDR Testing

   a. Reflective events (connections) shall not exceed the following limits. Where application limits are more stringent, those shall apply.
   b. 0.75 dB in optical loss when bi-directionally averaged
   c. -35 dB reflectance for multi-mode connections
   d. -40 dB reflectance for UPC single-mode connections
   e. -55 dB reflectance for APC single-mode connections
   f. Non-reflective events (splices) shall not exceed 0.3 db

3. Magnified End Face Inspection

   a. Fiber connections shall be visually inspected for compliance with IEC 61300-3-35 Edition 1.0 for end face quality.
   b. Scratched, pitted or dirty connectors shall be diagnosed and corrected.

4. When an Optical Fiber Link or Channel Fails

   a. All installed optical fiber cabling links and channels shall be field-tested and pass the test requirements and analysis as described in Part 3.

      1) Any link or channel that fails these requirements shall be diagnosed and corrected.
      2) Any corrective action that must take place shall be documented and followed with a new test to prove that the corrected link or channel meets performance requirements.
      3) The final and passing result of the tests for all links and channels shall be provided in the test results documentation, in accordance with Part 3.

C. Acceptance of Test Results

1. Once the project is fully completed and tested in accordance with the Contract Documents and to the satisfaction of the Owner, the Owner's acceptance of the test results shall be given in writing to the Engineer.

1.06 PROJECT CONDITIONS

A. Project Environmental Requirements

1. Seismic Safety

   a. Observe mechanical and electrical support means for all installed equipment as required by all applicable local building codes for this installation's earthquake risk hazard zone and as recommended by Telcordia Specification GR-63.
   b. All equipment racks should to be anchored with suitable anchors that meet safety standards.
   c. Overhead devices should be mounted with appropriate safety attachments as required.
   d. Where cabinets and racks are secured directly to the building, this should be done in accordance with guidance provided by the Authority Having Jurisdiction (AHJ) or

a structural engineer.

e. Equipment and fixtures should have shock and vibration isolation.

2. Fiber Optic Cable Safety

a. The following warnings shall be posted on the job site:

1) WARNING: PERMANENT EYE DAMAGE CAN RESULT FROM LOOKING DIRECTLY INTO A LIGHT BEAM GENERATED BY AN LED OR LASER SOURCE OR INTO THE END OF A CABLE FIBER CONNECTED TO ONE OF THESE SOURCES.

2) CAUTION: LIGHT GENERATED BY THESE SOURCES MAY NOT BE VISIBLE, YET REMAIN HAZARDOUS TO THE EYE. LOOK FOR WARNING LABELS ON SOURCE DEVICES.

b. Observe all warning signs on equipment and all written safety precautions in the equipment instruction and technical manuals.

c. Always handle cable carefully to avoid personal injury. Care should be taken with individual fibers to prevent injury to the eyes or penetration of the fibers into the skin.

3. Hazardous Materials Prohibition

a. The Contractor shall make sure that all materials used in the project are asbestos-free, unless specifically authorized in writing by the Owner.

b. Applicable products shall comply with the European directives on the Restriction of Hazardous Substances (RoHS; 2002/95/EC) and Waste Electrical and Electronic Equipment (WEEE; 2002/96/EC).

B. Existing Conditions

1. Verify that all conditions on the project site are acceptable for the Work specified in this Section. Prior to bid opening, notify the Consulting Engineer in writing of any discrepancies, conflicts, or omissions. Otherwise, correct these issues at no additional cost to the Owner.

2. Continue to monitor the project site. If conditions develop that require a variance from the Specifications or Drawings, then immediately notify the Owner in writing. Otherwise, make recommendations, submit drawings showing how the Work may be installed, and upon approval, proceed with the necessary changes without additional cost to the Owner.

C. Record Drawings

1. Keep a complete set of all telecommunications drawings in the job site office for reference of the actual installation of work under this Section.
2. Use this set of drawings for no other purpose.
3. Where any material, equipment, or system components are installed differently than what is shown on the Drawings, indicate the differences clearly and neatly using ink or indelible pencil.
4. Upon completion of the project, submit the record set of Drawings.

1.07 USE OF THE SITE

A. Where the Owner deems it necessary to place restrictions, use the site as directed by the Owner.

B. When proceeding with the work, do not interfere with the ordinary use of streets, aisles, passages, exits, or operations of the Owner. During the day, set up cones and barriers in hallways and walkways. Do not string cable down the hallways during normal hours.

C. Request a hazardous materials worksheet that identifies potentially-hazardous locations. Do not proceed with any work in locations where hazardous materials are known to be. Obtain instructions from the Contractor's Project Manager on how and when to work in these areas.

D. Multiple times each day, each installation contractor shall remove all trash and debris from the site.

E. Before leaving the room each day:

1. The Contractor shall replace all ceiling tiles that they have removed.
2. The Contractor shall place all furniture and equipment that they have moved back into its original location.
3. The Contractor shall return any equipment that they have disconnected to working order.
4. The Contractor's Job Foreman shall inspect all work locations to make sure that the rooms are clean and that all of the tasks described above have been done.
5. It is recommended that the Contractor inspect the site and take pictures to document the condition of the ceilings and walls.

1.08 CONTINUITY OF SERVICES

A. Take no action that will interfere with, or interrupt, existing building services unless previous arrangements have been made with the Owner's representative. Arrange all work to minimize shutdown time.

B. The Owner's personnel shall perform shutdown of operating systems. When shutdown of systems is required, the contractor shall give three (3) days advance notice.

C. Should building services be inadvertently interrupted:

1. The Job Foreman shall immediately notify the Project Manager of the accidental disruption of services, the remedy, and how long it will take to restore services.
2. The Contractor shall immediately furnish the labor, including overtime, the material, and the equipment necessary to promptly restore the interrupted service at no cost to the Owner.

PART 2 PRODUCTS

2.01 BALANCED TWISTED-PAIR CABLE TESTERS

A. The field test instrument shall be manufactured by Fluke Networks.

B. The field test instrument shall have been calibrated within the last twelve months.

C. There shall be independent verification that the field test instrument meets the following accuracy requirements:

1. For Category 5E, Level IIe accuracy in accordance with ANSI/TIA-1152
2. For Category 6, Level III accuracy in accordance with ANSI/TIA-1152
3. For Category 6A, Level IIIe accuracy in accordance with ANSI/TIA-1152

D. Permanent Link Adapters

1. The 8-position plug must meet the requirements for NEXT, FEXT, and Return Loss in accordance with ANSI/TIA-568-C.2 Annex C.
2. Twisted pair Category 5e, 6, 6A, 7, or 7A cords are not permitted, as their performance degrades with use and can cause false Return Loss failures.

E. Results Storage

1. The field test instrument shall be capable of storing more than 10,000 results for all measurements found within this section.

F. Measurement Capabilities for Category 5E and Category 6 Links

1. On Category 5E and Category 6 links, the field test instrument shall be capable of testing the following parameters:

a. Wire Map
b. Length
c. Propagation Delay
d. Delay Skew
e. DC Loop Resistance
f. DC Resistance Unbalance within a pair
g. DC Resistance Unbalance between pairs
h. Insertion Loss
i. Near-End Crosstalk (NEXT)
j. Power Sum Near-End Crosstalk (PS NEXT)
k. Attenuation to Crosstalk Ratio Near-End (ACR-N)
l. Power Sum Attenuation to Crosstalk Ratio Near-End (PS ACR-N)
m. Attenuation to Crosstalk Ratio Far-End (ACR-F)
n. Power Sum Attenuation to Crosstalk Ratio Far-End (PS ACR-F)
o. Return Loss
p. Transverse Conversion Loss (TCL)
q. Equal Level Transverse Conversion Transfer Loss (ELTCTL)
r. Time Domain Reflectometer
s. Time Domain Xtalk Analyzer

G. Measurement Capabilities for Category 6A

1. On Category 6A links, the field test instrument shall be capable of testing all of the parameters listed above for Category 5E and Category 6 links and all of the following parameters:

a. Power Sum Alien Near-End Crosstalk (PS ANEXT)
b. Average Power Sum Alien Near-End Crosstalk (Average PS ANEXT)
c. Power Sum Alien Attenuation to Crosstalk Ratio Far-End (PS AACR-F)
d. Average Power Sum Alien Attenuation to Crosstalk Ratio Far-End (Average PS AACR-F)

H. PC Software

1. The field test instrument’s PC software shall:

a. Be Windows® based
b. Show when 3 dB and 4 dB rules are applied
c. Have re-certification capability where results have “(RC)” added to the end of the Cable IDs
d. Have a built-in PDF export capability, as no additional third party software is permitted
e. Have built-in statistical analysis

2.02 OPTICAL FIBER CABLE TESTERS

A. The field test instrument shall have been calibrated within the period recommended by the manufacturer, and a copy of the calibration certificate shall be made available.

B. Optical Loss Test Set (OLTS)

1. Multi-Mode Optical Fiber Light Source
    a. The multi-mode optical fiber light source shall:
        1) Provide dual LED light sources with central wavelengths of 850 nm (±30 nm) and 1300 nm (±20 nm). VCSEL sources are not permitted per ANSI/TIA-526-14-B.
        2) Have output power of at least –20 dBm
        3) Meet the Encircled Flux launch requirements of ANSI/TIA-526-14-B
        4) Have test reference cords that demonstrate an insertion loss of 0.15 dB when mated against each other
        5) Be manufactured by Fluke Networks
2. Single-Mode Optical Fiber Light Source
    a. The single-mode optical fiber light source shall:
        1) Provide dual laser light sources with central wavelengths of 1310 nm (±20 nm) and 1550 nm (±20 nm).
        2) Have output power of at least –10 dBm
        3) Have test reference cords that demonstrate an insertion loss of 0.25 dB when mated against each other
        4) Be manufactured by Fluke Networks
3. Power Meter
    a. The power meter shall:
        1) Provide test capability at wavelengths of 850 nm, 1300 nm, 1310 nm, and 1550 nm
        2) Have power measurement uncertainty of ±0.25 dB
        3) Store reference power measurements
        4) Save at least 10,000 results to internal memory
        5) Have a USB PC interface
        6) Be manufactured by Fluke Networks
4. Optional Length Measurement
    a. An OLTS capable of measuring the optical length of the fiber using time-of-flight techniques is preferable.
    b. For MPO/MTP trunk cables, length shall be calculated using cable jacket length markings.

C. Optical Time Domain Reflectometer (OTDR)
1. The OTDR shall:
    a. Have a color LCD display with backlight
    b. Have rechargeable Li-Ion battery for 8 hours of normal operation
    c. With battery and module, weigh no more than 4.5 pounds and have a volume of no more than 200 in^2
    d. Have internal non-volatile memory with capacity for storing at least 2,000 OTDR bi-directionally-tested fiber links
    e. Have a USB port to transfer data to a PC or thumb drive/memory stick
    f. Be manufactured by Fluke Networks
2. The multi-mode OTDR shall:
    a. Provide test capability at wavelengths of 850 nm (±10 nm) and 1300 nm (+35 nm / -15 nm)
    b. Have event dead zones that do not exceed 0.7 m at 850 nm and 1300 nm

c. Have attenuation dead zones that do not exceed 2.5 m at 850 nm and 4.5 m at 1300 nm
d. Have distance range of at least 9,000 m
e. Have a dynamic range of at least 28 dB for 850 nm and 30 dB at 1300 nm
f. Allow bi-directional testing without moving the OTDR to the far end

3. The single-mode OTDR shall:

a. Provide test capability at wavelengths of 1310 nm (±25 nm) and 1550 nm (±30 nm)
b. Have event dead zones that do not exceed 0.6 m at 1310 nm and 1550 nm
c. Have attenuation dead zones that do not exceed 3.7 m at 1310 nm and 1550 nm
d. Have distance range of at least 80 km at 1310 nm and 130 km at 1550 nm
e. Have a dynamic range of at least 32 dB for 1310 nm and 30 dB at 1550 nm
f. Allow bi-directional testing without moving the OTDR to the far end

D. Fiber Microscope

1. The fiber microscope shall:

a. Have a field of view of 420 µm by 320 µm
b. Have camera probe tips that permit inspection through adapters
c. Be capable of saving and reporting the end face image to IEC 613003-3-35
d. Be manufactured by Fluke Networks
e. Preferably be a video camera system

E. Integrated OLTS, OTDR, and Fiber Microscope

1. Test equipment that combines an OLTS, an OTDR, and a fiber microscope into one instrument may be used.
2. Any such system shall be manufactured by Fluke Networks.

2.03 ADMINISTRATION

A. Administration documentation shall include the test results of each permanent link.

B. Upon completion of the test of each link, the test result information for that link shall be recorded in the memory of the field test instrument.

C. The test result records saved in the field test instrument shall be transferred into a Windows®-based database utility that allows for the maintenance, inspection, and archiving of these test records.

PART 3 EXECUTION

3.01 GENERAL

A. Prior to field-testing, all outlets, cables, patch panels, and associated components shall be fully assembled and labeled. Any testing performed on incomplete systems shall be redone after the systems are fully assembled and labeled.

B. Upon completion of the work, a Registered Communications Distribution Designer (RCDD) shall submit as-built Drawings to the Owner or Owner's representative.

C. The Contractor shall input the cabling data into the cable management software.

3.02 SYSTEM ADMINISTRATION

A. Test Results Documentation

1. At the end of each working day, upload the copper cable permanent link test results,

except for alien crosstalk testing, to the associated PC software for inspection by the Owner or the Owner's representative.

2. Test results uploaded shall allow for the maintenance, inspection, and archiving of the test records.
3. Prior to the Owner accepting the project:
    a. Store the database of the complete project, including, if applicable, fiber links, in the format native to the software.
    b. Deliver the database to the Owner on CD, DVD, or thumb-drive.
    c. To allow the Owner to inspect and print the test reports, include a working and fully-licensed copy of the software.
4. Circuit IDs reported by the test instrument should match the specified label ID. (See "LABELS" below)
5. Provide the detailed test results documentation data, in an electronic database, for each tested optical fiber and include the following information:
    a. The identification of the customer site as specified by the end-user
    b. The name of the test limit selected to execute the stored test results
    c. The name of the personnel performing the test
    d. The date and time that the test results were saved in the memory of the tester
    e. The manufacturer, model, and serial number of the field test instrument
    f. The version of the test software and the version of the test limit database held in the test instrument
    g. The fiber identification number
    h. The length of each optical fiber
    i. The index of refraction used for length calculation when using a length-capable OLTS
    j. The backscatter coefficient of the fiber under test when using an OTDR
    k. The OLTS attenuation link and channel measurements at the appropriate wavelengths and the margin (the difference between the measured attenuation and the test limit value)
    l. The OTDR link and channel traces, event tables at the appropriate wavelengths, and a map of the link tested
    m. The length of each optical fiber, as calculated by the OTDR
    n. The overall pass/fail evaluation of the link-under-test for OLTS and OTDR measurements
    o. A picture or image of each fiber end-face
    p. A pass/fail status of the end-face using IEC 61300-3-35 Edition 1.0
6. Testing of Category 5E and Category 6 Permanent Links
    a. For each Category 5E and Category 6 balance twisted-pair permanent link, provide the detailed test results documentation data in the associated PC software including:
        1) The overall pass/fail evaluation of the link-under-test
        2) The date and time the test results were saved in the memory of the tester
        3) The identification of the customer site, as specified by the Owner
        4) The name of the test limit selected to execute the stored test results
        5) The name of the personnel performing the test
        6) The version of the test firmware and the version of the test limit database held in the test instrument
        7) The manufacturer, model, and serial number of the field test instrument
        8) The adapters used
        9) The factory calibration date
        10) A aire map
        11) Propagation delay values for all four pairs

12) Delay skew values for all four pairs
13) DC resistance values for all four pairs
14) DC resistance unbalance within a pair values for all four pairs
15) DC resistance unbalance between pairs values for all four pairs
16) Insertion loss worst case values for all four pairs
17) NEXT worst-case margin and worst-case values in both directions
18) PS NEXT worst-case margin and worst-case values in both directions
19) ACR-N worst-case margin and worst-case values in both directions
20) PS ACR-N worst-case margin and worst-case values in both directions
21) ACR-F worst-case margin and worst-case values in both directions
22) PS ACR-F worst-case margin and worst-case values in both directions
23) Return loss worst-case margin and worst-case values in both directions
24) TCL worst-case margin and worst-case values in both directions
25) ELTCTL worst-case margin and worst-case values in both directions
26) Time domain crosstalk data, if the link is marginal or fails
27) Time domain reflectometer data, if the link is marginal or fails

7. Testing of Category 6A Permanent Links

a. For each Category 6A balance twisted-pair permanent link, provide all of the same detailed test results documentation data required for Category 5E and Category 6 permanent links and also the detailed test results documentation data for alien crosstalk testing, in AxTalk Analyzer, including:

1) PS ANEXT worst-case margin for all four pairs
2) Average PS ANEXT worst-case margin
3) PS AACR-F worst-case margin for all four pairs
4) Average PS AACR-F worst-case margin

B. Submit test reports within seven (7) business days of completion of testing.

3.03 FIELD QUALITY CONTROL

A. General

1. The Owner reserves the right to be present during any or all of the testing.
2. All cabling not tested in strict accordance with these specifications shall be re-tested at no additional cost to the Owner.
3. 100% of the installed cabling must be tested. All tests must meet the acceptance criteria defined in the media specific sections of this document.
4. Prior to each day's testing, fully charge all test equipment and bring an appropriate alternate power source to the job site.
5. Throughout the testing, have a competent supervisor and supporting technical personnel, acceptable to the Owner, available on site. Changing the supervisor during the testing shall not be acceptable without prior written approval from the Owner.
6. Upon completion of the testing, it shall be the responsibility of the Contractor to perform the necessary adjustments and other controls to ensure proper system operation. The system shall be physically inspected by the Owner to assure that all equipment is installed in a neat and workmanlike manner as called for by the contract documents.
7. Verify the performance parameters of the individual systems, following established professional procedures, in addition to those specified herein. Document all acceptance testing, calibration, and correction procedures described herein, taking care to include the following information:

a. The date on which each procedure was performed
b. The reason that the procedure was performed
c. The type of and a description of the procedure

d. The parameters measured and their values, including, as applicable, the values measured prior to calibration or correction
e. The parameters associated with calibration or corrective networks, components, or devices
f. The names of the personnel conducting the procedure
g. The equipment used to conduct the procedure

B. General Specifications for Testing Balanced Twisted Pair Cable

1. Use field test instruments that have the latest firmware installed.
2. Upon completion of each test, record the permanent link test results, including the individual frequency measurements from the tester, in the test instrument for subsequent uploading to the associated test equipment software in which the administrative documentation (reports) may be generated.
3. Perform permanent link testing on each cabling segment, connector to connector. Sampling is not acceptable.
4. Perform alien crosstalk testing on all Category 6A links using a sampling plan. For populations of up to 500,000 links, use an Acceptance Quality Level (AQL) of 0.4%, normal inspection, general inspection level I, as defined in ISO 2859-1. The following table lists the sample sizes to be used.

Total number of links (N)	**Sample size (No. Of links to test)**
3 – 33	3 or 0.1 x N (whichever is greatest)
34 – 3,200	33
3,201 – 35,000	126
35,001 – 150,000	201
150,001 – 500,000	315

5. Choose an equal combination of short, medium, and long disturbed (victim) links for alien crosstalk testing.
6. Permanent link adapters made from twisted pair Category 5e, Category 6, or Category 6A cords are not permitted.
7. The installer shall build a reference Category 6A link. All components shall be anchored so that it is not possible to disturb them. Each day, the technician is to conduct a Category 6A permanent link test to ensure that there is no degradation of the tester or its permanent Llink adapters.

3.04 TESTING CATEGORY 5E LINKS

A. Frequency Resolution

1. The frequency resolution for all measurements shall be:

a. 1 – 31.25 MHz: 150 kHz
b. 31.25 – 100 MHz: 250 kHz

B. Wire Map Measurement

1. The length of each balanced twisted pair shall be recorded.

C. Propagation Delay

1. Record the propagation delay measurement at 10 MHz, per ANSI/TIA-1152. Per ANSI/TIA-568-C.2 Section 6.3.18, the propagation delay of each balanced twisted pair shall not exceed 498 ns.

D. Delay Skew

1. Record the delay skew measurement of each balanced twisted pair. Per ANSI/TIA-568-C.2 Section 6.3.19, the delay skew measurement is not to exceed 44 ns.

E. DC Resistance

1. For all four pairs:

   a. Record DC resistance
   b. Record DC resistance unbalance

F. Insertion Loss

1. Report the worst case for all four pairs in one direction only.
2. Mark reported margins found to be within the accuracy of the field tester with an asterisk (*).
3. Insertion loss is not to exceed the limits for Category 5e permanent links specified in ANSI/TIA-568-C.2 Section 6.3.7.

G. Near-End Crosstalk (NEXT)

1. Measure NEXT in both directions for all 12 possible pair-to-pair combinations.
2. Report both worst case and worst margins.
3. NEXT is not to exceed the limits for Category 5e permanent links specified in ANSI/TIA-568-C.2 Section 6.3.8.
4. Mark reported margins found to be within the accuracy of the field tester with an asterisk (*).
5. Store the time domain Xtalk data for any marginal or failing NEXT results.

H. Power Sum Near-End Crosstalk (PS NEXT)

1. Measure PS NEXT in both directions for all 8 possible pair-to-pair combinations.
2. Report both worst case and worst margins.
3. PS NEXT is not to exceed the limits for Category 5e permanent links specified in ANSI/TIA-568-C.2 Section 6.3.9.
4. Mark reported margins found to be within the accuracy of the field tester with an asterisk (*).
5. Store the time domain Xtalk data for any marginal or failing PS NEXT results.

I. Attenuation Crosstalk Ratio Near-End (ACR-N)

1. Calculate ACR-N in both directions.
2. Record ACR-N for all 12 possible combinations.

J. Power Sum Attenuation Crosstalk Ratio Near-End (PS ACR-N)

1. Calculate PS ACR-N in both directions.
2. Record PS ACR-N for all 8 possible combinations.

K. Attenuation Crosstalk Ratio Far-End (ACR-F)

1. Measure ACR-F in both directions.
2. Report both worst case and worst margins.
3. ACR-F is not to exceed the limits for Category 5e permanent links specified in ANSI/TIA-568-C.2 Section 6.3.11.
4. Mark reported margins found to be within the accuracy of the field tester with an asterisk (*).

L. Power Sum Attenuation Crosstalk Ratio Far-End (PS ACR-F)

1. Measure PS ACR-F in both directions.
2. Report both worst case and worst margins.
3. PS ACR-F is not to exceed the limits for Category 5e permanent links specified in ANSI/TIA-568-C.2 Section 6.3.13.
4. Mark reported margins found to be within the accuracy of the field tester with an asterisk (*).

M. Return Loss

1. Measure return loss in both directions.
2. Report both worst case and worst margins.
3. Ignore return loss at all frequencies where the insertion loss is less than 3 dB for that pair.
4. Return loss is not to exceed the limits for Category 5e permanent links specified in ANSI/TIA-568-C.2 Section 6.3.6.
5. Mark reported margins found to be within the accuracy of the field tester with an asterisk (*).
6. Store the Time Domain Reflectometer data for any marginal or failing return loss results.

N. Transverse Conversion Loss (TCL)

1. Measure TCL in both directions.
2. Record TCL for all 8 possible combinations.

O. Equal Level Transverse Conversion ELTCTL Transfer Loss (ELTCTL)

1. Measure ELTCTL in both directions.
2. Record ELTCTL for all 8 possible combinations.

3.05 TESTING CATEGORY 6 LINKS

A. Frequency Resolution

1. The frequency resolution for all measurements shall be:
   a. 1 – 31.25 MHz: 150 kHz
   b. 31.25 – 100 MHz: 250 kHz
   c. 100 – 250 MHz: 500 kHz

B. Wire Map Measurement

1. The length of each balanced twisted pair shall be recorded.

C. Propagation Delay

1. Make the propagation delay measurement, per ANSI/TIA-1152, at 10 MHz.
2. Record the propagation delay of each balanced twisted pair.
3. Propagation delay shall not exceed 498 ns per ANSI/TIA-568-C.2 Section 6.3.18
4. Record the delay skew measurement for each balanced twisted pair.
5. Per ANSI/TIA-568-C.2 Section 6.3.19, propagation delay is not to exceed 44 ns.
6. Record DC resistance for all four pairs.
7. Record DC resistance unbalance for all four pairs.

D. Insertion Loss

1. Report the worst case for all four pairs in one direction only.
2. Mark reported margins found to be within the accuracy of the field tester with an asterisk (*).
3. Insertion loss is not to exceed the limits for Category 6 permanent links specified in ANSI/TIA-568-C.2 Section 6.3.7.

E. Near-End Crosstalk (NEXT)

1. Measure NEXT in both directions for all 12 possible pair-to-pair combinations.
2. Report both worst case and worst margins.
3. NEXT is not to exceed the limits for Category 6 permanent links specified in ANSI/TIA-568-C.2 Section 6.3.8.
4. Mark reported margins found to be within the accuracy of the field tester with an asterisk (*).
5. Store the time domain Xtalk data for any marginal or failing NEXT results.

F. Power Sum Near-End Crosstalk (PS NEXT)

1. Measure PS NEXT in both directions for all 8 possible pair combinations.
2. Report both worst case and worst margins.
3. PS NEXT is not to exceed the limits for Category 6 permanent links specified in ANSI/TIA-568-C.2 Section 6.3.9.
4. Mark reported margins found to be within the accuracy of the field tester with an asterisk (*).
5. Store the time domain Xtalk data for any marginal or failing PS NEXT results.

G. Attenuation Crosstalk Ratio Near-End (ACR-N)

1. Calculate ACR-N in both directions.
2. Record ACR-N for all 12 possible combinations.

H. Power Sum Attenuation Crosstalk Ratio Near-End (PS ACR-N)

1. Calculate PS ACR-N in both directions.
2. Record PS ACR-N for all 8 possible combinations.

I. Attenuation Crosstalk Ratio Far-End (ACR-F)

1. Measure ACR-F in both directions for all 24 possible pair-to-pair combinations.
2. Report both worst case and worst margins.
3. ACR-F is not to exceed the limits for Category 6 permanent links specified in ANSI/TIA-568-C.2 Section 6.3.11.
4. Mark reported margins found to be within the accuracy of the field tester with an asterisk (*).

J. Return Loss

1. Measure return loss in both directions for all 8 possible pair combinations.
2. Report worst case and worst margins.
3. Ignore return loss at all frequencies where the insertion loss is less than 3 dB for that pair.
4. Return loss is not to exceed the limits for Category 6 permanent links specified in ANSI/TIA-568-C.2 Section 6.3.6.
5. Mark reported margins found to be within the accuracy of the field tester with an asterisk (*).
6. Store the time domain reflectometer data for any marginal or failing return loss results.

K. Transverse Conversion Loss (TCL)

1. Measure TCL in both directions.
2. TCL for a permanent link is not specified in ANSI/TIA-1152, but record it for all 8 possible combinations.

L. Equal Level Transverse Conversion Transfer Loss (ELTCTL)

1. Measure ELTCTL in both directions.
2. Record ELTCTL for all 8 possible combinations.

M. TESTING CATEGORY 6A LINKS

1. Frequency Resolution

a. The frequency resolution for all measurements shall be:

1) 1 – 31.25 MHz: 150 kHz
2) 31.25 – 100 MHz: 250 kHz
3) 100 – 250 MHz: 500 kHz
4) 250 – 500 MHz: 1000 kHz

N. Wire Map Measurement

1. Record the length of each balanced twisted pair.

O. Propagation Delay

1. Measure the propagation delay, per ANSI/TIA-1152, at 10 MHz.
2. Record the propagation delay of each balanced twisted pair.
3. Per ANSI/TIA-568-C.2 Section 6.3.18, the propagation delay shall not exceed 498 ns.

P. Delay Skew

1. Record the delay skew measurement for each balanced twisted pair.

Q. DC Loop Resistance

1. Report the DC loop resistance for all four pairs.
2. Per ANSI/TIA-568-C.2 Section 6.3, DC loop resistance is not to exceed 21 Ω for all four pairs.

R. DC Resistance Unbalance within a Pair

1. Report DC resistance unbalance within a pair for all four pairs.
2. Per ANSI/TIA-568-C.2 Section 6.2.2, DC resistance unbalance within a pair is not to exceed 200 mΩ or 3%, whichever is the greatest.

S. DC Resistance Unbalance between Pairs

1. Shall be Reported DC resistance unbalance between pairs for the following pairs:

1,2-3,6	1,2-7,8	3,6-7,8
1,2-4,5	3,6-4,5	4,5-7,8

2. DC resistance unbalance between pairs is not to exceed 200 mΩ or 7.5%, whichever is the greatest.

T. Insertion Loss

1. Report both worst case and worst margins, in one direction, for all four pairs.
2. Mark reported margins found to be within the accuracy of the field tester with an asterisk (*).
3. Insertion loss is not to exceed the limits for Category 6A permanent links specified in ANSI/TIA-568-C.2 Section 6.3.7.

U. Near-End Crosstalk (NEXT)

1. Report both worst case and worst margins in both directions for all pair combinations.

2. NEXT is not to exceed the limits for Category 6A permanent links specified in ANSI/TIA-568-C.2 Section 6.3.8.
3. Mark reported margins found to be within the accuracy of the field tester an asterisk (*).
4. Store the time domain Xtalk data for any marginal or failing NEXT results.

V. Power Sum Near-End Crosstalk (PS NEXT)

1. Report both worst case and worst margins in both directions for all four pairs.
2. PS NEXT is not to exceed the limits for Category 6A permanent links specified in ANSI/TIA-568-C.2 Section 6.3.9.
3. Mark reported margins found to be within the accuracy of the field tester with an asterisk (*).
4. Store the time domain Xtalk data for any marginal or failing PS NEXT results.

W. Attenuation Crosstalk Ratio Near-End (ACR-N)

1. Report both worst case and worst margins in both directions for all pair combinations.
2. Record ACR-N for all twelve possible combinations.

X. Power Sum Attenuation Crosstalk Ratio Near-End (PS ACR-N)

1. Report both worst case and worst margins in both directions for all four pairs.
2. Record PS ACR-N for all eight possible combinations.

Y. Attenuation Crosstalk Ratio Far-End (ACR-F)

1. Report both worst case and worst margins in both directions for all 12 pair combinations.
2. ACR-F is not to exceed the limits for Category 6A permanent links specified in ANSI/TIA-568-C.2 Section 6.3.11.
3. Mark reported margins found to be within the accuracy of the field tester with an asterisk (*).

Z. Power Sum Attenuation to Crosstalk Ratio Far-End (PS ACR-F)

1. Report both worst case and worst margins in both directions for all four pairs.
2. PS ACR-F is not to exceed the limits for Category 6A permanent links specified in ANSI/TIA-568-C.2 Section 6.3.13.
3. Mark reported margins found to be within the accuracy of the field tester with an asterisk (*).

AA. Return Loss

1. Report both worst case and worst margins in both directions for all four pairs.
2. Ignore return loss at all frequencies where the insertion loss is less than 3 dB for that pair.
3. Return loss is not to exceed the limits for Category 6A permanent links specified in ANSI/TIA-568-C.2 Section 6.3.6.
4. Mark reported margins found to be within the accuracy of the field tester with an asterisk (*).
5. Store the time domain reflectometer data for any marginal or failing return loss results.

BB. Transverse Conversion Loss (TCL)

1. Report both worst case and worst margins in both directions for all four pairs.
2. TCL is not to exceed the limits for Category 6A permanent links specified in ANSI/TIA-568-C.2 Section 6.2.14.

CC. Equal Level Transverse Conversion Transfer Loss (ELTCTL)

1. Report both worst case and worst margins in both directions for all four pairs.
2. ELTCTL is not to exceed the limits for Category 6A permanent links specified in ANSI/TIA-568-C.2 Section 6.2.16.

DD. Power Sum Alien Near-End Crosstalk (PS ANEXT)

1. The disturbed (victim) link shall have disturber links to the left and right of it and, if such links are present, above and below it.
2. Disturber cables shall include all links within the same bundle as the disturbed (victim) link and adjacent links.
3. If the link is patch-panel-to-patch-panel, then measure PS ANEXT in both directions. If the link is patch-panel-to-telecommunications-outlet, then measure PS ANEXT from the patch panel end only.
4. PS ANEXT is not to exceed the limits for Category 6A permanent links specified in ANSI/TIA-568-C.2 Section 6.3.21.

EE. Power Sum Alien Near-End Crosstalk (Average PS ANEXT)

1. Calculate average PS ANEXT by averaging the individual PS ANEXT loss values, in dB, for all four pairs in the disturbed (victim) link.
2. PS ANEXT is not to exceed the limits for Category 6A permanent links specified in ANSI/TIA-568-C.2 Section 6.3.22.

FF. Power Sum Alien Attenuation to Crosstalk Ratio Far-End (PS AACR-F)

1. PS AACR-F shall be the calculated power sum from all external pairs into the disturbed (victim) pair.
2. The disturbed (victim) link shall have disturber links to the left and right of it and, if such links are present, above and below it.
3. Disturber cables shall include all links within the same bundle as the disturbed (victim) link and adjacent links. I the link is patch-panel-to patch-panel, then measure PS AACR-F in both directions. If the link is patch-panel-to-telecommunications-outlet, then measure PS AACR-F from the patch panel end only.
4. PS AACR-F is not to exceed the limits for Category 6A permanent links specified in ANSI/TIA-568-C.2 Section 6.3.25

GG. Power Sum Alien Attenuation to Crosstalk Ratio Far-End (Average PS AACR-F)

1. Calculate Average PS AACR-F by averaging the individual PS AACR-F values, in dB, for all four pairs in the disturbed (victim) link.
2. The disturbed (victim) link shall have disturber links to the left and right of it and, if such links are present, above and below it.
3. Disturber cables shall include all links within the same bundle as the disturbed (victim) link and adjacent links.
4. If the link is patch-panel-to-patch-panel, measure Average PS AACR-F in both directions. If the link is patch-panel-to-telecommunications-outlet, then measure Average PS AACR-from the patch panel end only.
5. Average PS AACR-F is not to exceed the limits for Category 6A permanent links specified in ANSI/TIA-568-C.2 Section 6.3.26.

3.06 TESTING OPTICAL FIBER CABLE

A. General

1. All tests performed on optical fiber cabling that use a laser or LED in a test set shall be carried out with in accordance with the safety precautions specified in ANSI Z136.2.
2. Prior to field-testing, fully assemble and label all outlets, cables, patch panels, and associated components. Any testing performed on incomplete systems shall be redone

after the systems are fully assembled and labeled.

3. Use field test instruments that have the latest software and firmware installed.
4. Upon completion of each test, record the link and channel test results from the OLTS and OTDR in the test instrument for subsequent uploading to a PC in which the administrative documentation (reports) may be generated.
5. Inspect fiber end faces using a video scope with a field of view of no less than 425 µm x 320 µm.
6. Record the end face images in the memory of the test instrument for subsequent uploading to a PC and reporting.
7. Perform testing on each cabling segment, connector to connector. Sampling is not acceptable.
8. Test the cabling using high-quality test reference cords that:

    a. Are of the same core size as the cabling under test
    b. Are terminated with reference grade connectors that have a loss of no more than 0.1 dB for multi-mode and 0.2 dB for single-mode
    c. For OLTS testing, are between 2 m and 5 m long
    d. For multi-mode OTDR testing, have launch and tail fibers that are at least 100 m (328 feet) long
    e. For single-mode testing, have launch and tail fibers of lengths appropriate for the link under test, as indicated in the following table

Maximum length of link (km)		**Typical pulse Width (ns)**	**Minimum launch And tail cord Length (m)**
1310 nm	**1550 nm only**		
0 to 35	0 to 50	= 1,000	130
35 to 45	50 to 65	3,000	400
45 to 50	65 to 75	10,000	1,000
= 50	= 75	20,000	2400

B. Optical Loss Testing for Horizontal and Backbone Links

1. Test multi-mode links in both directions at 850 nm and 1300 nm in accordance with ANSI/TIA-526-14-B, one-cord reference method, with an Encircled Flux compliant launch.
2. Single-mode backbone links shall be tested in both directions at 1310 nm and 1550 nm in accordance with ANSI/TIA/EIA-526-7, Method A.1 (the one-cord reference method).

C. OTDR Testing

1. Test fiber links at the following wavelengths for anomalies and to ensure uniformity of cable attenuation, connector insertion loss, and reflectance:

    a. For multi-mode: 850 m and 1300 nm
    b. For single-mode: 1310 nm and 1550 nm

2. Test each fiber link and channel in both directions.
3. For the measurement in the opposite direction, leave the launch and tail fibers in place. Failing to do so will result in an increase in measurement uncertainty.
4. Using a loop back fiber at the far end with a tail fiber at the near end on the adjacent fiber is permitted for bi-directional testing, as long as the OTDR can split the trace automatically into two traces for the two fibers under test.
5. Install a launch cable between the OTDR and the first link connection.
6. Install a tail cable after the last link connection.

D. Magnified End-Face Inspection

1. Inspect fibers using a video scope with a minimum field of view of 425 µm by 320 µm per

IEC 61300-3-35 Edition 1.0.

2. Use the following test limits:
    a. For multi-mode connectors, Table 6 of IEC 61300-3-35 Edition 1.0
    b. For single-mode field polished connectors, Table 5 of IEC 61300-3-35 Edition 1.0
    c. For single-mode factory polished connectors, Table 3 of IEC 61300-3-35 Edition 1.0
    d. For Angled Physical Contact (APC) connectors, Table 4 of IEC 61300-3-35 Edition 1.0
3. Length Measurement
    a. Record the length of each fiber.
    b. It is preferable that the optical length be measured using an OLTS or OTDR.
4. Polarity Testing
    a. Test paired duplex fibers in multi-fiber cables to verify that polarity is in accordance with Clause E.5.3 of ANSI/TIA-568-C.0.
    b. Verify the polarity of the paired duplex fibers using an OLTS.

E. Manufacturer's Field Service
1. At the start of the installation, periodically as the Work progresses, and after completion, furnish:
    a. The services of the manufacturer's technical representative at the job site, as needed, to advise on every phase of the Work
    b. Full-time attendance at least during the first three work days and at least once every week thereafter
    c. Technical assistance to the Installer as required

END OF SECTION

SECTION 27 1100

COMMUNICATIONS EQUIPMENT ROOM FITTINGS

PART 1 GENERAL

1.01 SUMMARY

A. This Section includes the specifications for:

1. The supply, delivery, supervision, coordination, and installation of equipment items specified herein and shown on drawings
2. The specifications for the incorporation of Owner Furnished Equipment (OFE)
3. The testing, documentation, and instructions for completing the Communications Equipment Room.
4. Products supplied but not installed under this section, including loose equipment specified herein which is to be turned over to the owner at the completion of this project.

B. Owner Furnished Equipment (OFE)

1. Certain equipment may be identified as Owner Furnished Equipment (OFE). This OFE may presently be part of the Owner's system, or may be provided by the Owner, and will either be delivered to the Contractor's off-site construction facility, be delivered to the Contractor's on-site secured storage area, or be installed on site by others, as appropriate, for incorporation into the system.

    a. Clean and inspect all OFE.
    b. Notify the Owner in writing of damage, defects, and the extent of any repair or adjustment required for the OFE to meet the original specification.
    c. Service OFE only as directed by the Owner under the arrangements of a separate contract, and incorporate repaired or adjusted OFE into the system as if provided new, except for warranty coverage.

C. Related Drawings

1. T-Series drawings follow the specifications in this section.
2. Electrical drawings specify the electrical requirements.
3. Interior Design drawings specify the interior finishes, spatial relationships between items, and mounting heights.

D. What the Contractor Shall Provide and Install

1. Although such work is not specifically mentioned herein or on the drawings, the Contractor shall furnish and install all miscellaneous items, accessories, appurtenances, and devices incidental to or necessary for a sound, secure and complete installation, without claim for additional payment.
2. The Contractor shall provide system testing and demonstration, system documentation and instruction of Owner personnel without claim for additional payment.

E. Errors or Omissions in Drawings or Documentation

1. If any errors or omissions appear in Drawings, Specifications, or other documents, the bidding Contractor shall notify the Engineer no later than ten (10) days prior to submitting the bid.
2. Should conflict occur in or between drawings and specifications, the bidding Contractor is deemed to have estimated the more expensive way of doing the work, unless the bidding Contractor has asked for and a obtained written decision (addendum), before submission of the bid, as to which method or materials will be required.

F. Dimensions

1. Dimensions indicated are limiting dimensions.

a. Do not use equipment exceeding dimensions indicated.
b. Do not use equipment or arrangements that reduce the required clearances or exceed the specified maximum dimensions.

1.02 REFERENCES

A. Requirements, Codes, and Standards

1. Design, manufacture, test, and install telecommunications cabling networks per the manufacturer's requirements and in accordance with latest revision of the NFPA-70 (National Electrical Code®), state codes, local codes, requirements of Authorities Having Jurisdiction (AHJs), and the following standards including the most current revisions, addendums, and any Technical Service Bulletins (TSBs) released at the time of bid:

a. ANSI/NECA/BICSI 607 – Standard for Telecommunications Bonding and Grounding Planning and Installation Methods for Commercial Buildings
b. ANSI/BICSI 002 Data Center Design and Implementation Best Practices
c. ANSI/TIA 568 Series – Telecommunications Cabling Standards
d. TIA-569 -– Commercial Building Standard for Telecommunications Pathways and Spaces
e. TIA-606 – Administration Standard for Commercial Telecommunications Infrastructure
f. TIA-607 – Generic Telecommunications Bonding and Grounding (Earthing) for Customer Premises
g. TIA-526 Series – Standard Test Procedures for Fiber Optic Systems
h. NECA/FOA 301– Installing and Testing Fiber Optic Cables
i. TIA-942 – Telecommunications Infrastructure Standard for Data Centers
j. ISO/IEC 11801– Generic Cabling for Customer Premises

B. BICSI® Publications

1. Install cabling in accordance with the most recent edition of the following BICSI® Publications:

a. BICSI – Telecommunications Distribution Methods Manual
b. BICSI – Information Technology Systems Installation Manual
c. BICSI – Outside Plant Design Reference Manual

C. Applicability of Codes, Rules, and Regulations

1. Federal, state, and local codes, rules, regulations, and ordinances governing the work, are as fully part of the specifications as if herein repeated or hereto attached.
2. If the Contractor notes items in the drawings or the specifications, construction of which would be code violations, the Contractor should promptly call them to the attention of the Owner's representative in writing.
3. Where the requirements of other Sections of the specifications are more stringent than applicable codes, rules, regulations, and ordinances, the specifications shall apply.

D. Manufacturers' Recommendations

1. To maintain the applications warranties, install all cabling and termination devices using the manufacturers' recommended installation practices.

E. Definitions

1. AWG – American Wire Gauge – The standardized wire gauge system for the diameter of

round, solid, nonferrous, electrically-conducting wire.

2. BBC – Bonding Backbone Conductor – A telecommunication bonding connection which interconnects telecommunications bonding backbones. Formerly known as the grounding equalizer.
3. BD – Building Distributor – A distributor in which the building backbone cables terminate and at which connections to the campus backbone cables may be made.
4. BN – Bonding Network – A set of interconnected conductive structures that provides a low impedance path for the associated telecommunications infrastructure.
5. CP – Consolidation Point – A connection facility within Cabling Subsystem 1 for interconnection of cables extending from building pathways to the equipment outlet.
6. EDA – Equipment Distribution Area – A space allocated for end equipment, including computer systems and telecommunications equipment.
7. EF – Entrance Facility – An entrance to a building for both public and private network service cables, including wireless that includes the entrance point of the building and continues to the entrance room or space.
8. ER – Equipment Room – An environmentally-controlled, centralized space for telecommunications equipment that serves the occupants of the building, considered distinct from a Telecommunications Room (TR) because of the nature or complexity of the equipment.
9. ESD – Electro Static Discharge – The sudden flow of electricity between two electrically-charged objects caused by contact, an electrical short, or dielectric breakdown.
10. HC – Horizontal Cross-connect – A group of connectors, such as patch panels or punch-down blocks, that allow horizontal, backbone, and equipment cabling to be cross-connected with patch cords or jumpers.
11. HDA – Horizontal Distribution Area – A space in a computer room where a Horizontal Cross-connect (HC) is located, and which may include LAN switches, Storage Area Network (SAN) switches, and Keyboard/Video/Mouse (KVM) switches for the end equipment located in the Equipment Distribution Areas (EDAs).
12. IC – Intermediate Cross-connect – A facility enabling the termination of different levels of backbone cabling and interconnection between them or equipment.
13. MC – Main Cross-connect – A facility enabling the termination of backbone cables and their connection to incoming services, other backbone cabling, or equipment.
14. MDA – Main Distribution Area –The central point of distribution for the structured cabling system, which includes the Main Cross-connect (MC) and, when equipment areas are served directly from the MDA, may also include Horizontal Cross-connect (HC).
15. Mesh-BN – Mesh Bonding Network – A bonding network to which all associated equipment, such as cabinets, frames, racks, trays, and pathways, are connected using a bonding grid that is connected to multiple points on the common bonding network.
16. PBB – Primary Bonding Busbar – A busbar placed in a convenient and accessible location and bonded, by means of the Telecommunications Bonding Conductor (TBC), to the building's service equipment (power) ground. Formerly known as the Telecommunications Main Grounding Busbar (TMGB).
17. RBB – Rack Bonding Busbar – A busbar within a cabinet, frame, or rack.
18. RBC – Rack Bonding Conductor – A bonding conductor from the rack or Rack Bonding Busbar (RBB) to the Telecommunications Equipment Bonding Conductor (TEBC).
19. RU – Rack Unit A unit of measure, compliant with EIA 310, used to describe the height of equipment intended for mounting on equipment rails. One RU is 1.75 inches (44.45 mm) high.
20. SBB – Secondary Bonding Busbar – A common point of connection for telecommunications system and equipment bonding to ground, located in the distributor room. Formerly known as the Telecommunications Grounding Busbar (TGB).
21. TBB – Telecommunications Bonding Backbone – The conductor that interconnects the Primary Bonding Busbar (PBB) to the Secondary Bonding Busbar (SBB).
22. TBC – Telecommunications Bonding Conductor – A conductor that interconnects the telecommunications bonding infrastructure to the building's service equipment (power) ground. Formerly known as the bonding conductor for telecommunications.

23. TEBC – Telecommunications Equipment Bonding Conductor – A conductor that connects the Primary Bonding Busbar (PBB) or Secondary Bonding Busbar (SBB) to equipment racks or cabinets.
24. TO – Telecommunications Outlet – A connecting device, located in a work area, at which the horizontal cabling terminates.
25. TR – Telecommunications Room – An enclosed space for housing telecommunications equipment, cable terminations, and cross-connect cabling. It is the recognized location of the cross-connect between the backbone and horizontal facilities.
26. UBC – Unit Bonding Conductor – A bonding conductor from equipment or a patch panel to a Rack Bonding Conductor (RBB) or a Rack Bonding Busbar (RBB).
27. ZDA – Zone Distribution Area – A space where a zone outlet or consolidation point is located, between the horizontal and equipment distribution areas, that allows frequent reconfiguration and flexibility.

1.03 PERMITS, FEES, AND CERTIFICATES OF APPROVAL

A. If required, the Owner or Owner's authorized agent will make application for and pay for any building permits.

1.04 SYSTEM DESCRIPTION

A. The Contractor will provide, install, and test a complete structured cabling system for the project's voice and data communications systems from the Telecommunications Outlet (TO) to the Telecommunications Room (TR), and between telecommunications spaces. The Contractor will provide and install all required components as identified below.

B. Backbone Cable

1. Vertical and horizontal backbone cabling will consist of hybrid optical fiber cable, installed from each TR to the ER.
2. Provide fiber distribution enclosures at each end, sized for the number of fibers to be installed. Terminate with field-installable connectors or fusion splicing of factory cable assemblies and modular connector panels.
3. For UTP backbone, provide IDC-type wiring blocks at each end, sized for the number of twisted pair cable assemblies to be installed. Terminate to connection blocks as stipulated in the Construction Documents.

C. Typical Equipment Room (ER)

1. A typical ER will consist of the following equipment:

a. Open racks and/or enclosures with vertical and horizontal wire management
b. 24-port or 48-port patch panels for termination of the horizontal cables served from this room
c. Fiber Distribution Enclosures (FDEs)
d. Fire-resistant plywood installed on at least one (1) wall, at a height of 96 inches Above the Finished Floor (AFF) on which to install wall-mounted equipment
e. A rack-mounted Uninterruptible Power System (UPS)
f. Rack-mounted Power Outlet Units (POUs)
g. One or more racks or enclosures to house network servers and switch equipment
h. A grounding and bonding system connected to the building's main grounding electrode system
i. A cable runway system, installed above the racks in the ER, to support and manage the cabling that runs from the racks to the equipment in the space, which shall be fitted with the proper termination and entrance equipment, such as waterfalls, support components, and bonding equipment

D. Typical Telecommunications Room (TR)

1. A typical TR will consist of the following equipment:
    a. One or more 84-inch floor-mounted open racks, wall-mounted racks, or enclosures, which shall have horizontal and vertical cable management, and, when open floor-mounted racks are used, horizontal stabilization, which may be provided by the cable runway from the rack to the wall, though if this is insufficient, shall have supports fabricated by the Contractor
    b. Termination hardware supporting all horizontal and backbone cabling
    c. Rack-mounted FDEs for termination and interconnection of the optical fiber backbone
    d. A rack-mounted Uninterruptible Power Supply (UPS) system
    e. A rack-mounted POU
    f. Fire-resistant plywood installed on at least one (1) wall at a height of 96 inches AFF on which to install wall-mounted equipment
    g. A grounding and bonding system connected to the building's main grounding electrode system
    h. A cable runway system installed above the racks to support and manage the cabling that runs from the racks to equipment in the space, which shall be fitted with the proper termination and entrance equipment such as waterfalls, support, and bonding equipment

E. Pathways and Raceways

1. Pathways and raceways are the support system for the infrastructure. All pathways and raceways shall conform to the referenced ANSI/TIA-569-B Commercial Building Standard for Pathways and Spaces.
2. All horizontal and backbone cable shall be properly supported every 48 inches to 60 inches.
3. Infrastructure support systems include, but may not be limited to the following:
    a. Properly-supported cable trays and cable runway
    b. Properly-supported conduits, inside or outside, above ground or underground
    c. Non-continuous cable supports, which shall be spaced no more than 60 inches apart
    d. Surface raceway systems that may consist of metallic or non-metallic raceways and boxes

F. Using a Combination of Cable Supports

1. The preferred method for providing pathways is to use a combination of cable tray and non-continuous cable supports.
    a. Cable trays shall be used for main horizontal cable pathways on all levels from the ER and TR locations.
    b. Cable trays shall be installed in the main corridors.
    c. In areas of low cable density, use independently-supported non-continuous cable supports in lieu of the cable tray system.
    d. All backbone cable shall also follow these cable tray pathways.
    e. Horizontal UTP and auxiliary system cables shall be combed and independently bundled. Bundle ties shall be easily removed for the addition or removal of cables and shall be plenum-rated.
    f. To allow for future maintenance and access, the primary cable routes shall be located over corridors.
    g. To protect cable from damage and to provide a suitable aesthetic appearance, in areas where the cable may be exposed, such as in open-ceiling rooms, conduit or surface raceway must be used instead of non-continuous cable supports.

1.05 SUBMITTALS

A. Engineer's Review

1. The Engineer's review of shop drawings or samples shall not relieve the Contractor of responsibility for any deviation from the contract documents.
2. With the shop drawings, the Contractor shall include an index sheet detailing all deviations from the contract documents, and will be held responsible for all deviations unless the Contractor has received written approval from the Engineer for the specific deviation, separate from general shop drawing approval.
3. The Engineer's review shall not relieve the Contractor from responsibility for errors or omissions in the shop drawings or samples.

B. General Component Data

1. For all products covered under this Section, the Contractor shall submit the following data for each component covered under this Section:

   a. A Specification Section reference
   b. The manufacturer's name
   c. The manufacturer's model and part numbers

C. Racks

1. In addition to the general requirements above, the Contractor shall submit the following additional data:

   a. Rack specifications, including material, dimensions, color, accessories, and mountings
   b. Drawings of equipment

D. Backboards

1. In addition to the general requirements above, the Contractor shall submit the following additional data:

   a. Drawings of telephone backboard color coding and equipment layout
   b. Data on backboard thickness and fire rating
   c. Data on backboard construction and dimensions

E. Connectors

1. In addition to the general requirements above, the Contractor shall submit the following additional data:

   a. Connector specifications, including material, dimensions, attenuation, Near-End CrossTalk (NEXT) connection losses, ratings, and construction
   b. A drawing of the equipment

F. Splicing and Terminations

1. In addition to the general requirements above, the Contractor shall submit data on splicing and terminating tools, materials, and method

G. Testing

1. In addition to the general requirements above, the Contractor shall submit the following additional data:

   a. The equipment serial number
   b. A graphic diagram documenting the test procedure, including all connectors, the light source (as applicable,) the origin, and the destination of each cable tested

1.06 QUALITY ASSURANCE

A. Standards for Materials and Equipment

1. The Contractor shall provide all materials, equipment, and installation in compliance with the latest applicable standards from ANSI, FCC, ASTM, EIA/TIA, IEEE, NEC, NFPA, NEMA, OSHA, REA, and UL.
2. The Contractor shall provide all electronic equipment with the UL label when applicable.

B. Installer Qualifications

1. Registered Communications Distribution Designer (RCDD)

a. The Contractor must have at least one (1) Registered Communications Distribution Designer (RCDD) as recognized by Building Industry Consulting Service International (BICSI). The RCDD must be a full-time employee of the Contractor, and shall be responsible for the compliance of the work with the referenced standards and guidelines. At the time of bid, the RCDD shall provide a professional resume and proof of current registration to the Engineer for approval. The RCDD shall be present during construction and all cable testing and shall have:

1) Knowledge of BICSI installation standards
2) Knowledge of NEC standards
3) Knowledge of ANSI/TIA standards
4) Five (5) years of experience in the installation of optical fiber cables, including splicing, terminating, and testing, including single and multimode
5) Three (3) years of experience in the installation of Category 3 and Category 6 Unshielded Twisted Pair (UTP) copper cables for voice and data distribution systems, including splicing, terminating, and testing, including complete verification of compliance with ANSI/TIA cable standards
6) Five (5) references for projects of equivalent scope, type, and complexity of work completed within the last five (5) years. – The Contractor shall submit, as proof, supporting documents and the names, addresses, and telephone numbers of the operating personnel who can be contacted regarding the installation of the system
7) Certification by the termination equipment manufacturer as an installer

C. Other Installers

1. Products shall only be installed by qualified technicians certified by the manufacturers.

D. Compliance with Laws, Ordinances, and Codes

1. As applicable, all electronic equipment provided shall have the UL label.
2. Comply in every way with the requirements of local laws and ordinances, the National Board of Fire Underwriters, and the National Electrical Code. Anything in the plans or specifications that does not strictly comply with the above laws, ordinances, and rules must be referred to the attention of the Engineer for a decision before proceeding. No change in the plans or specifications shall be made without full consent, in writing, of the Engineer.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Handling

B. To prevent damage, theft, soiling, and misalignment, protect equipment during transit, storage, and handling.

C. The Contractor shall coordinate the secure storage of equipment and materials on site, or, if no on-site storage is available, shall provide their own secure storage at the Contractor’s expense.

1. Do not store equipment where conditions fall outside manufacturer's recommendations for environmental conditions.
2. Do not install damaged equipment. Remove environmental conditions from the site, and replace damaged equipment with new equipment.
3. If off-site storage of materials is required, this shall be at the contractor's expense.

1.08 COORDINATION

A. Installation Schedule

1. The Contractor shall coordinate with all other trades. Within 10 days of contract being awarded, the Contractor will submit a schedule for the installation.

    a. The schedule shall include delivery, installation, and testing for conformance to specific job completion dates.
    b. At minimum, the schedule shall provide dates for the start of demolition, the completion of demolition, the start of installation, the completion of horizontal cabling, the completion of riser cabling, the completion of testing and labeling, cutover, the completion of the final punch list, final inspection, and acceptance.

B. Meeting Attendance and Schedule Adherence

1. The Contractor must attend all project-related meetings and adhere to the schedule set by the Project Manager.

C. Final Inspection

1. The Contractor is required to notify the Engineer of a proposed appointment for Final Inspection at least 72 hours before the appointment.
2. Within five working days after the final inspection, the Contractor shall send final project documentation and warranty information to the Owner and Engineer. The final project documentation shall include, but may not be limited to:

    a. As-Built Drawings, in AutoCAD format, with legible outlet addresses and cable paths.
    b. Outlet location spreadsheets
    c. Warranty paperwork
    d. A copy of the Final Inspection and Acceptance Signoff Sheet
    e. Photos of each ER and TR

1.09 PROJECT CONDITIONS

A. Project Environmental Requirements

1. Seismic Safety

    a. Provide mechanical and electrical support for all installed equipment as required by all applicable local building codes for this installation's earthquake risk hazard zone and as recommended by Telcordia Specification GR-63.
    b. Anchor all equipment racks with suitable anchors that meet safety standards.
    c. Mount overhead devices with appropriate safety attachments as required.
    d. Where cabinets and racks are secured directly to the building, this shall be done in accordance with guidance provided by the Authority Having Jurisdiction (AHJ) or a structural engineer.
    e. Provide shock and vibration isolation of equipment and fixtures as required.

2. Fiber Optic Cable Safety

    a. The following warnings shall be posted on the job site:

        1) WARNING: PERMANENT EYE DAMAGE CAN RESULT FROM LOOKING

DIRECTLY INTO A LIGHT BEAM GENERATED BY AN LED OR LASER SOURCE OR INTO THE END OF A CABLE FIBER CONNECTED TO ONE OR THESE SOURCES.

2) CAUTION: LIGHT GENERATED BY THESE SOURCES MAY NOT BE VISIBLE, YET REMAIN HAZARDOUS TO THE EYE. LOOK FOR WARNING LABELS ON SOURCE DEVICES.

b. Observe all warning signs on equipment and all written safety precautions in the equipment instruction and technical manuals.

c. Always handle cable carefully to avoid personal injury. Care should be taken with individual fibers to prevent injury to the eyes or penetration of the fibers into the skin.

3. Hazardous Materials Prohibition

a. The Contractor shall make sure that all materials used in the project are asbestos-free, unless specifically authorized in writing by the Owner.

b. Applicable products shall comply with the European directives on the Restriction of Hazardous Substances (RoHS; 2002/95/EC) and Waste Electrical and Electronic Equipment (WEEE; 2002/96/EC).

B. Existing Conditions

1. Verify that all conditions on the project site are acceptable for the Work specified in this Section. Prior to bid opening, notify the Consulting Engineer in writing of any discrepancies, conflicts, or omissions. Otherwise, correct these issues at no additional cost to the Owner.
2. Continue to monitor the project site. If conditions develop that require a variance from the Specifications or Drawings, then immediately notify the Owner in writing. Otherwise, make recommendations, submit drawings showing how the Work may be installed, and upon approval, proceed with the necessary changes without additional cost to the Owner.

C. Record Drawings

1. Keep a complete set of all telecommunications drawings in the job site office for demonstration of actual installation of work under this Section.
2. Use this set of drawings for no other purpose.
3. Where any material, equipment, or system components are installed differently than what is shown on the Drawings, indicate the differences clearly and neatly using ink or indelible pencil.
4. Upon completion of the project, submit the record set of Drawings.

1.10 USE OF THE SITE

A. Where the Owner deems it necessary to place restrictions, use the site as directed by the Owner.

B. When proceeding with the work, do not interfere with the ordinary use of streets, aisles, passages, exits, or operations of the Owner. During the day, set up cones and barriers in hallways and walkways. Do not string cable down the hallways during normal hours.

C. Request a hazardous materials worksheet that identifies potentially-hazardous locations. Do not proceed with any work in locations where hazardous materials are known to be. Obtain instructions from the Contractor’s Project Manager on how and when to work in these areas.

D. Multiple times each day, each installation contractor shall remove all trash and debris from the site.

E. Before leaving the room each day:

1. The Contractor shall replace all ceiling tiles that they have removed.
2. The Contractor shall place all furniture and equipment that they have moved back into its original location.
3. The Contractor shall return any equipment that they have disconnected to working order.
4. The Contractor's Job Foreman shall inspect all work locations to make sure that the rooms are clean and that all of the tasks described above have been done.
5. It is recommended that the Contractor inspect the site and take pictures to document the condition of the ceilings and walls.

1.11 CONTINUITY OF SERVICES

A. Take no action that will interfere with, or interrupt, existing building services unless previous arrangements have been made with the Owner's representative. Arrange all work to minimize shutdown time.

B. The Owner's personnel shall perform shutdown of operating systems. When shutdown of systems is required, the contractor shall give three (3) days advance notice.

C. Should building services be inadvertently interrupted:

1. The Job Foreman shall immediately notify the Project Manager of the accidental disruption of services, the remedy, and how long it will take to restore services.
2. The Contractor shall immediately furnish the labor, including overtime, the material, and the equipment necessary to promptly restore the interrupted service at no cost to the Owner.

1.12 WARRANTY

A. The Contractor shall provide the following warranties for the system and components.

1. Contractor Materials and Labor Warranty

a. The Contractor shall provide system warranties, for a period specified in the contract documents, against faulty materials and defects in workmanship. The Contractor shall also honor any manufacturer warranties that exceed this period of time.

2. Manufacturer Component Warranty

a. All components of the communication room fittings shall be free from manufacturing defects in material or workmanship, under normal and proper usage for a minimum of one (1) year.

B. The Manufacturer shall bear the burden to replace or repair any defective products during the warranty period at their cost, including labor and materials.

C. The warranty period shall begin on the date of the Owner's Acceptance of the Work. Evaluation of quality and workmanship shall be solely by the Owner or the Owner's representatives.

1.13 OWNER INSTRUCTION

A. At the time of substantial completion, the Contractor shall submit the system Operation Manual and the Maintenance Data Manual, each neatly bound, with tabbed dividers between sections, and a title page with space for submittal stamps.

B. Operation Manual

1. The Operation Manual shall include:

a. A Table of Contents
b. A typed description of each system, including key features and operational concepts such as remote control features, switching or routing functions, patch points, and mixing and linking capabilities
c. Set-up diagrams and typed instructions for use in typical situations, as directed by the Engineer
d. Small-scale plans showing locations and circuit numbers of all system outlets and receptacles
e. Single-line block diagrams showing all major system components
f. Two sets of A-size drawings showing the components and wiring in each individual rack, one drawing of each rack mounted in a plastic jacket on the rear door of the associated rack and a complete drawing set included in the manual
g. Manufacturers' equipment operation manuals intended for use by the system users
h. A properly-licensed working copy of the latest version of any and all software required to operate or configure the systems specified herein, including, but not limited to, all software, firmware, and hardware required for configuration, adjustment, diagnosis, and repair

    1) All software shall be fully documented, and that documentation shall be included in the Operation Manual.
    2) Software shall be included in its installable state on industry standard CD-ROM or other appropriate format. Disk images are unacceptable.
    3) Back-up of the working software may also be provided.

i. A key schedule cross-referencing all keys to their respective functions

C. Maintenance Data Manual

1. The Maintenance Data Manual shall include:

    a. A Table of Contents
    b. The company name, address, telephone number, and contact name for system service or maintenance
    c. A listing of all equipment and materials, with the names of the manufacturers and the model numbers or part numbers.
    d. Catalog data sheets that include the manufacturers' names, addresses, and telephone numbers
    e. Product manufacturers' warranties and a typed one-year system warranty explicitly covering all materials and labor
    f. The manufacturers' service manuals for all major equipment items
    g. Test documentation showing the results of source quality control tests, field quality control tests, acceptance testing, and certification
    h. A recommended preventative maintenance schedule with:

        1) References to the applicable pages in the manufacturers' maintenance manuals
        2) Where inadequate information is provided by the manufacturer, the information required for proper maintenance

D. Electronic Submittal

1. In addition to hard copy submittals, the Contractor shall submit all files needed to produce the above submittals:

    a. Transportation media \ in Microsoft® structure on CD-ROM or USB flash drive
    b. A Master File List, in text format, on each medium, with a short description of files in the submittal
    c. Drawings in AutoCAD R2010 or later drawing format (.DWG), that include all XREFs, fonts, and other drawing parts required for the drawings

1) **Note:** Drawing Exchange File Format (.DXF) is not acceptable.

d. Word processing files in MS Word 2007 format
e. Graphs and charts in MS Excel 2007 format
f. All graphic images required for the reproduction of the submittals in the files in JPEG (.JPG) file format
g. Manufacturers' data sheets, equipment manuals, and other documentation provided by the manufacturers to the Contractor or documents that are similarly not otherwise available to the Contractor in electronic format shall be excluded from this requirement.

E. Keys

1. Submit three copies of all keys required for access to and operation of the systems.

1.14 COMMISSIONING

A. Furnish one initial set of product brochures and owner's manuals to the ***[Architect] [Engineer]*** for use during acceptance testing and equalization.

PART 2 PRODUCTS

2.01 GENERAL NOTES

A. In this section, certain products are specified by manufacturer and part number to establish a level of quality, performance, and consistency. To substitute other products would defeat this effort to the Owner's detriment. If no manufacturer or part number is specified for a part, then that part is generic, and the Contractor shall submit for approval a part that provides the performance specified herein.

B. All products in this section shall be manufactured by Panduit

C. All materials and products, including Owner Furnished Equipment (OFE), shall be:

1. Appropriate for the intended use
2. Recognized as such by a Nationally Recognized Testing Laboratory (NRTL) such as Underwriters Laboratories (UL), ETL SEMCO (ETL), the Canadian Standards Association (CSA), or the American National Standards Institute (ANSI)
3. Permitted for the application by the Authority Having Jurisdiction (AHJ)

D. Electrical components shall bear the UL or ETL label, and this listing shall apply to the entire assembly. Only systems and equipment that meet or exceed the level of quality and the capabilities stated in this document will be considered for acceptance.

E. All products shall be new, of the latest version at time of bid, and brought to the job site in the original manufacturer's packaging. Used equipment and damaged material will be rejected.

F. Any modifications to equipment to suit the intent of the specifications shall be performed in accordance with these requirements.

G. Cable lubricants specifically designed for installing communications cable may be used as needed to reduce pulling tension when pulling cable into conduit.

H. Take care during installation to prevent scratches, dents, chips, etc. Equipment with significant or disfiguring cosmetic flaws will be rejected.

I. All components will be approved by the Engineer and shall have the highest aesthetic value possible while providing the specified functionality. Hardware shall:

1. Be in compliance with the Construction Documents
2. Have fit and finish compatible with the existing surrounding structure
3. Be unobtrusive
4. Provide the required functionality

J. All work area termination hardware, including mounting boxes, faceplates, and outlets, shall match the existing wall surface color as closely as possible.

K. All copper and fiber products shall be from a single manufacturer so that a single performance warranty covers all applications on vertical and horizontal links.

L. Fabricate custom-made equipment with careful consideration given to aesthetic, technical, and functional aspects of equipment and its installation.

M. Provide products that are suitable for the intended use, including, but not limited to environmental, regulatory, and electrical.

2.02 2-POST RACKS

A. 2-post racks shall:

1. Be manufactured of aluminum
2. Have a black epoxy-polyester hybrid powder coat finish
3. Be assembled with nut and bolt hardware
4. Be rated for a maximum of 1,000 pounds (455 kg) of equipment
5. Be UL listed

B. Each 2-post rack will have:

1. Two L-shaped top angles
2. Two L-shaped base angles pre-punched with six (6) holes for attachment to the floor
3. Two C-shaped equipment-mounting channels

C. Equipment mounting channels will:

1. Be 3 inches (75 mm) deep
2. Be punched on the front and rear flange with the universal hole pattern specified by EIA-310-D to provide 45 rack-mount spaces for equipment
3. Have each mounting space marked and numbered on the mounting channel
4. Have attachment points threaded with 12-24 roll-formed threads
5. When assembled with top and bottom angles, allow attachment of 19-inch (483 mm) EIA rack-mount equipment
6. Have sides (webs) that are punched to allow attachment of vertical cable managers along the sides of the rack or to allow rack-to-rack baying

D. Each 2-post rack will include:

1. Assembly and equipment-mounting hardware that provides electrical continuity between components
2. Twenty-four 24 combination pan head pilot point mounting screws
3. At least twenty-four (24) spare screws
4. Horizontal stabilization hardware
5. Appropriate fasteners for mechanically attaching the rack to the structural floor

E. The assembled rack will measure 84 inches (2.1 m) high, 20.3 inches (516 mm) wide, and 15 inches (381 mm) deep.

F. All racks shall be grounded per the TIA-607 standard and per state and local codes.

G. Panduit Design Makes:

Part Number	Description
R2P	Standard Rack - 84” High (2134mm) 45 RU, with #12-24 thread screws
RFAKIT	Rack Floor Attachment Kit

2.03 4-POST RACKS

A. 4-post racks shall:

1. Have frames manufactured of steel
2. Have a black epoxy-polyester hybrid powder coat finish
3. Be assembled with nut and bolt hardware
4. Be rated for a maximum of 2,500 pounds (1,100 kg) of equipment
5. Be UL listed

B. Each 4-post rack frame will have:

1. Two L-shaped top angles pre-punched for attaching cable runway with J-bolts
2. Two L-shaped base angles pre-punched for attachment to the floor
3. Four adjustable L-shaped equipment-mounting rails: a front pair and a rear pair
4. Have four steel frame posts, the sides (webs) of which will be punched to allow:
    a. Attachment of vertical cable managers along the sides of the frame
    b. Frame-to-frame or frame-to-rack baying, including with a 2-post relay rack

C. Equipment mounting rails will:

1. Be L-shaped and free from the four posts
2. Be adjustable front to back after the rack has been mounted to a floor
3. Have a universal hole-pattern, as specified by EIA-310-D, to provide 45 rack-mount spaces for equipment
4. Have each mounting space marked and numbered on the mounting rail
5. Have attachment points threaded with 12-24 roll-formed threads or square punched cage nuts
6. Be spaced to allow attachment of 19-inch (483 mm) EIA rack-mount equipment

D. Each 4-post rack frame will include:

1. Assembly and equipment-mounting hardware that provides electrical continuity between components
2. Twenty-five (25) combination pan head pilot point mounting screws or cage nuts
3. At least twenty-five (25) spare screws

E. The assembled frame will measure 84 inches (2.1 m) high, 23.3 inches (591 mm) wide, and 30 inches (767 mm) deep, with no more than 30 inches (767 mm) between the front and rear mounting surfaces of the two pairs of mounting rails.

F. All racks shall be grounded per the TIA-607 standard and State and local codes.

G. Panduit Design Makes:

Part Number	Description
R4P	30” Deep 4 Post Rack
RFAKIT	Rack Floor Attachment Kit

2.04 FLOOR-MOUNT ENCLOSURES

A. The enclosures shall be available with a width of 31.5 inches (800 mm), depths of 42 inches (1067 mm) and 48 inches (1219 mm), and multiple heights.

B. Floor-mount enclosures shall be constructed with:

1. Vertical posts and doors constructed of 16-gauge steel
2. EIA mounting rails constructed of 14-gauge steel
3. Side panels constructed of 20-gauge steel
4. A top constructed of 18-gauge steel
5. At least 45RU of useable interior height

C. Floor-mount enclosures shall be:

1. Constructed using an electrically-continuous inset frame
2. Equipped with a single point bonding location at the top and bottom

D. Enclosures shall be available with:

1. Optimized cooling and security features for server, networking, and telecom applications in an IT environment
2. A top with integral molded edge protection
3. Snap-in covers pre-installed in cable entry openings
4. Lockable, ventilated, reversible doors with front dual-hinge doors or single-hinge doors with 69% open perforation and rear split doors
5. Adjustable mounting depth
6. Cable organizers and front and rear cable management fingers
7. A grounding kit
8. An environmental monitoring unit
9. At least twenty-five (25) spare screws

E. All enclosures shall be bonded in compliance with ANSI/TIA-607-C-1 and state and local codes. The entire assembly shall be fully electrically bonded, including equipment rails, door and side panels.

F. Enclosures shall have a 3,000 pound (1360 kg) static load rating and 2,250 pound (1020 kg) rolling load rating.

G. Panduit Design Makes:

Part Number	Description
S8522B	Server Cabinet, 800mm (W), 45RU, 1200mm (D), Black, Vertical Blanking Panel, No VED, Two Standard Side Panels, Single Hinge Perforated Front Door, Split Rear Perforated Door, Standard Locks, Cage Nut Rails, No Cable Mgmt, Left PDU Bracket 6” Wide (1 set), No Right PDU Brackets, No Integral Top Pathway, Casters
SPDUBRK	PDU Brackets for S Style Cabinet, BL
N8522B	Network Cabinet, 800mm(W), 45RU, 1200mm(D), Black, No Vertical Blanking Panel, No VED, Two Standard Side Panels, Dual Hinge Perforated Front Door, Split Rear Perforated Door, Standard Locks, #12-24 Tapped Rails, Two Sets Long Cable Mgmt Fingers, No Left PDU Brackets, No Right PDU Brackets, No Integral Top Pathway, No Casters
NVPDUB	PDU Brackets for N Type Switch Cabinet, BL

2.05 VERTICAL EXHAUST DUCTS

A. Vertical exhaust duct shall channel heat from server exhaust directly to the return plenum.

B. The system shall be passive, containing no moving parts.

C. The vertical exhaust duct shall be modular, and shall be capable of being added without disrupting existing in-cabinet equipment or cabling.

D. The duct shall be adjustable from 20 inches (508 mm) to 70 inches (1.8 m), and shall be fitted with a flexible sealing collar for mating to a return air plenum interface.

E. Ducts shall be from the same manufacturer as the enclosures to which they attach.

F. Panduit Design Makes:

Part number	Description	Unit of Measure	Std. Pkg. Qty	Std. Ctn. Qty.
CDE1	Cabinet Air Inlet Duct for 1 RU Cisco 4948 Switch	piece	1	--
CDE2	Cabinet Air Inlet Duct for 2 RU Cisco Nexus N2K Switches	piece	1	--
CNLTD142A3	Net-Direct Cabinet Inlet Duct for Cisco Nexus 7009 Switch	piece	1	--
CNLTD21B2	Panduit Inlet Duct for Cisco 4900M Switch	piece	1	--
CNLTD52A2	Panduit Inlet Duct for Cisco 6504E Switch	piece	1	--
CNLTD72A3	Panduit Inlet Duct for Cisco 9506 Switch	piece	1	--
DIFBA2002S00S	Inlet Duct for Cisco 9396 Switch	piece	1	--
DIFBA3003S00S	Inlet Duct for Cisco 93128 Switch	piece	1	--
DIRBB2007S21W	Net-Direct Cabinet Air Inlet Duct for Cisco 7004 Switch	piece	1	--
DIRLC2214M21W	Net-Direct Cabinet Inlet Duct for Cisco 6509 Switch	piece	1	--
DIRLC25S23W	Inlet Duct for Cisco 6880 Switch	piece	1	--
DIRLC3210S17W	Inlet Duct for Cisco 6807 Switch	piece	1	--

2.06 SHELVES FOR RACKS AND ENCLOSURES

A. Shelves shall be:

1. Manufactured of sheet steel
2. Have a black epoxy-polyester hybrid powder coat finish
3. From the same manufacturer as the enclosure

B. Shelves will:

1. Have at least two points of support
2. Attach to the equipment mounting rails in the rack or enclosure so that there is support at each front corner of the shelf
3. Have a support surface that extends beyond the mounting rail (cantilever)
4. Be secured to equipment mounting rails with hardware at each attachment point

C. Shelves will be:

1. Fixed sliding and solid vented
2. Of a proper size to provide support for the entire width and depth of the equipment placed on the shelf
3. Rated for the load supported

D. The combined loads of equipment placed on shelves and of the shelves placed within an enclosure will not exceed the load bearing capacity of the enclosure or rack.

E. Panduit Design Makes:

Part Number	Description
RSHLF	19” X 30” Rack Shelf for 4 Post Rack

SRM19FM1	Rack Mount 19” (483mm) Front Mount Shelf 1 RU

2.07 HORIZONTAL AND VERTICAL CABLE MANAGEMENT

A. The system shall be a complete cable management system that has vertical cable managers, horizontal cable managers, and cable management accessories throughout the cabling system.

1. Vertical Cable Management for Racks and Enclosures

a. The vertical cable manager will create a space for storing and organizing cables along the side of the rack or frame and will maintain separation between cordage and premise cables.
b. The vertical cable manager shall be manufactured of sheet steel or aluminum and composite materials with an epoxy-polyester hybrid powder coat paint in a color that matches the rack or frame to which it is attached.
c. The vertical cable manager will be affixed to the side of racks or frames with manufacturer-supplied hardware.
d. Vertical cable managers will be either:

1) A single-sided C-shaped trough with a cover that will provide a single pathway.
2) A double-sided H-shaped trough with covers that will provide independent front and rear cable pathways and will have multiple, evenly-spaced, edge-protected, front-to-rear cable pass-through holes in the center divider.

e. All covers will be removable, hinged to open from the right or left side and will include a latch that will secure the cover in the closed position.
f. The manager shall accept a metal hinged door that can open to either side.
g. The vertical cable manager will have cable openings along both sides of the trough.

1) These cable openings will be formed by evenly-spaced flag-up-shaped cable guides, made from a composite plastic material (non-metallic) that will have rounded edges to protect cables.
2) When the cable manager is attached to a rack or frame, each cable opening will align with an RU on the rail.
3) Each opening will pass a minimum of twenty-four (24) 6 mm (.25-inch) OD patch cords.

h. The vertical cable manager will match the height of the racks or frames to which it is attached and will be of an appropriate size to accommodate the cabling. It shall be able to manage all of the cables on the rack without the aid of horizontal cable managers and shall be:

1) 83.5 inches (2120 mm) high
2) 6.0 inches (152 mm), 8.0 inches (203 mm), 10.0 inches (254 mm), or 12.0 inches (305 mm) wide
3) 15.9 inches (404 mm) or 27.5 inches (714 mm) deep

i. The initial quantity of cables in the cable manager will not exceed 40% of the interior area of the cable manager.
j. A single vertical cable manager shall be used between bayed racks or frames and will be of an appropriate size to accommodate the total cable requirements for both racks and frames. The manufacturer’s product documentation will state estimated cable fills for the cable manager.
k. The vertical cable manager shall consist of a metal backbone with cable management fingers that:

1) Align with EIA rack spacing

2) Are molded out of plastic
3) Provide integral bend radius control throughout the entire length
4) Are removable

l. The backbone of the vertical cable manager shall:

1) Be an open design
2) Accept 19-inch EIA accessories, such as strain relief bars, patch panels, blanking panels, and POUs, mounted vertically in a zero-RU format

B. Horizontal Cable Management for Racks and Enclosures

1. Provide horizontal cable managers as shown on the drawings.

a. Horizontal cable management devices will be appropriate for the intended purpose and will:

1) Provide containment and concealment of interconnect or equipment cordage in an enclosure or rack
2) Guide patch and equipment cords between the vertical cable manager and individual connections
3) Allow access for cables without blocking the jacks

b. The horizontal cable manager shall:

1) Be manufactured of sheet steel or aluminum and composite materials
2) Have a high-gloss epoxy-polyester hybrid powder coat paint in a color that matches the rack or enclosure

c. The horizontal cable manager will be of an appropriate size to accommodate cabling requirements. A single horizontal cable manager may be used to support multiple patch panels, as long as it can accommodate cable fill requirements. The horizontal cable manager will:

1) Be available in several widths and heights, as shown on the Drawings
2) Provide 1 RU of horizontal cable management for every RU of connectivity
3) Match the rack-mount width of the racks, frames, or cabinets that it serves
4) Attach to the front or rear of the equipment mounting rail with screws and will be of a size that fits within standard EIA-310-D spacing

d. The horizontal cable manager will:

1) Be a double-sided H-shaped trough
2) Fitted with a removable cover, hinged to open up or down, that will snap on to secure the cover in the closed position
3) Have bend-limiting slots or holes at the rear to facilitate front-to-rear cabling through the horizontal manager
4) Have bend-radius-controlling T-shaped cable guides, along the top and bottom surfaces
5) Have evenly-spaced cable openings, with rounded edges to protect cables, between the T-shaped cable guides to allow cables to enter and exit the cable manager in a neat and orderly fashion

C. Panduit Design Makes:

Part Number	Description
PRV6	PatchRunner Vertical Cable Manager Front & Rear 6” (152mm) for 84” High (2134mm) Racks
PRV10	PatchRunner Vertical Cable Manager Front and Rear 10” (254mm) for 84” High (2134mm) Racks

Part Number	Description
PRD6	PatchRunner 6” (152mm) Dual Hinge Door for 84” High (2134mm) Racks
PRD10	PatchRunner 10” (254mm) Dual Hinge Door for 84” High (2134mm) Racks
NCMHAEF4	Horizontal Cable Manager High Capacity Front Only 4 RU

2.08 WALL-MOUNTED CABLE MANAGEMENT

A. Vertical and horizontal cable and wire management supporting wall-mounted termination or connecting blocks shall be:

1. Modular
2. Integral to the block mountings
3. Constructed of metallic and/or high-strength composite materials
4. Designed to maintain the industry-recommended bend radius of the of associated cabling

B. All openings shall have rounded edges to prevent damage to associated cables.

C. Panduit Design Makes:

Part Number	Description
WBH2	Hinged Wall Mount Bracket 2 RU, 6” Deep (152mm)

2.09 ZONE ENCLOSURES

A. Wall-Mounted Zone Enclosures for Active Equipment

1. Wall-mounted zone enclosures that are to house active equipment shall:
   a. Be manufactured of 16-gauge steel
   b. Have a total load capacity of 150 pounds (68 kg)
2. Wall-mounted zone enclosures for active equipment shall:
   a. Meet TIA/EIA standards for consolidation point requirements
   b. Have UL 60950 and UL 1863 approvals
   c. Be NEMA Type 2 compliant
   d. Meet the requirements of Telcordia GR-487-CORE for tamper resistance
3. Wall-mounted zone enclosures for active equipment shall:
   a. Be equipped with a rotating 3RU patch panel bracket
   b. Support up to 3RU of active equipment and 3RU of passive components
   c. Have multiple conduit knockouts to route cables in and out of the enclosure
   d. Have a front door that can be opened from the right or the left

B. Wall-Mounted Zone Enclosures for Passive Equipment

1. Wall-mounted zone enclosure that are to house passive equipment shall:
   a. Be manufactured of 16-gauge steel
   b. Have total load capacity of 150 pounds (68 kg)
2. Wall-mounted zone enclosures for passive equipment shall meet TIA/EIA consolidation point standard requirements.
3. Wall-mounted zone enclosures for passive equipment shall:
   a. Be equipped with mounting points for up to four (4) 100-pair wiring block bases

b. Include a 2RU bracket for installation of EIA 19-inch panels
c. Have multiple conduit knockouts to route cables in and out of the enclosure
d. Be capable of surface and flush mounting in a wall cavity
e. Have a front door that can be opened from the right or from the left
f. Have a front door that is fitted with a mechanical lock

C. Wireless Enclosures

1. Ceiling-mounted and wall-mounted wireless enclosures shall be:

a. Fully manufactured of sheet aluminum, except for units designed for integral antenna Wireless Access Point (WAP) units, which may have a flat plastic window for radio frequency transmission
b. Have a white powder-coat paint finish
c. Delivered fully assembled

2. Each wireless enclosure will be rectangular in shape, so that a standard ceiling tile can be cut to allow the enclosure to fit into it or, with accessory brackets, sized to replace a single 2-foot by 2 foot (600 mm by 600 mm) drop ceiling tile.

a. Hanger brackets will be provided to allow the wireless enclosure to be mounted above the ceiling, with the body of the enclosure above the drop ceiling, supported from the structural ceiling by hanger wires. One side of the enclosure will be flush with the drop ceiling, and an access door on the flush surface will open into the work area below the drop ceiling, providing access to the equipment in the enclosure.
b. Keyhole features in the back of the wireless enclosure will allow the enclosure to be mounted to a wall. Stud-mounting is recommended. Knockouts will also be provided to allow access to the enclosure, if required, by conduit from behind the wall for power and data cables.

3. Each wireless enclosure shall have an access door that is fully-hinged and that will lock with a key in the closed position.
4. Wireless enclosures shall have knockouts for the antennas.

a. Enclosures that accept WAP units with directional antennas will have knockouts in the door allowing the antennas to protrude though the door.
b. WAP units with separate patch antennas will be provided with knockouts for mounting the antennas either on the door or, if the enclosure is wall-mounted, on the enclosure.

5. On fully metal doors, knockouts will be provided for LED viewing from outside a locked enclosure.
6. The wireless access point will be attached to the inside back of the enclosure and will support the WAP off the enclosure. A back plate will be supplied for WAP units that ship without back plates, otherwise a suitable back plate will be provided.
7. The enclosure will have one or more cable access ports located on the side of the enclosure. The port will include an approved fire-rated foam sealing kit. Cable tie points for securing cables will be located within the enclosure. The manufacturer will provide compatible cable management straps as a separate accessory.
8. The enclosure shall have optional drop ceiling mounting kits to allow flush mounting of the enclosure in a standard drop ceiling.
9. The enclosure will be UL Listed for use in a plenum space and shall be stated in the manufacturer’s product literature.

D. Ceiling-Mounted Enclosures for Active Equipment

1. Ceiling-mounted enclosures for active equipment shall allow network equipment to be located in the air handling space above a drop ceiling.
2. The enclosure shall;

a. Be manufactured of sheet aluminum
b. Have a gas-assist door.

3. The enclosure shall:

a. Be designed to accommodate passive network equipment including IDC wiring blocks and EIA 19-inch patch panel components
b. Support up to 5RU of rack-mountable components or equipment

4. The enclosure shall be equipped with a thermal management system within the enclosure to support high heat load applications including PoE-enabled network switches and uninterruptible power supplies.
5. The enclosure shall include a two-tiered TIA 19-inch mounting bracket with an integrated horizontal slack manager for cable management.

E. Ceiling-Mounted Enclosures for Passive Equipment

1. Ceiling-mounted enclosures for passive equipment shall:

a. Allow termination equipment to be located in the air handling space above a drop ceiling
b. Be designed to accommodate passive network equipment including IDC wiring blocks and TIA 19-inch patch panel components

2. The enclosure shall have:

a. A two-tiered TIA 19-inch mounting bracket with an integrated horizontal slack manager for cable management.
b. Flexible air-sealing cable ingress/egress grommets to facilitate moves, adds, and changes, while maintaining a plenum rating
c. An optional lockable cover to secure and protect the enclosure from unauthorized access

F. Consolidation Point Boxes

1. In-floor zone cabling boxes shall be:

a. Of steel and aluminum construction
b. Plenum rated and designed to separate the barriers of plenum/non-plenum environments and the workspace

2. In-floor boxes shall be available in multiple sizes and shall mount into the allocated space for standard 24-inch by 24-inch (600 mm by 600 mm) raised floor panels, with a minimum 6-inch (150 mm) depth.
3. In-floor zone cabling boxes shall accept TIA 19-inch flat rack-mountable patch panels.
4. In-floor zone cabling boxes for fiber shall be compatible with TIA-604-5 (MPO) cassette solutions.
5. The enclosure shall have an optional lockable cover to secure and protect it from unauthorized access.

2.10 AIR-SEALING ACCESSORIES

A. All raised-floor cutouts that allow communications cable to pass through raised floor tiles shall be equipped with a grommet that covers the inside edge of the hole in the raised floor tile to:

1. Protect cables from abrasion as they pass through the floor tile
2. Minimize bypass airflow

B. The grommet assembly shall be constructed of an electrostatic-dissipative flame-retardant polycarbonate outer ring with electrostatic-dissipative flame-retardant fabric.

C. The grommet shall provide sealing properties for multiple cable bundles placed anywhere within the cable cutout.

D. The grommet shall be designed to allow for new and retrofit applications.

E. To allow for compatibility with vertical cable managers and cabinets, the grommet shall be available in multiple sizes.

F. The grommet shall have a low-profile design that does not have rigid features higher than 0.710 inches (18 mm) above the raised floor surface.

G. Panduit Design Makes:

Part Number	Description
CTGN3X5	Cool Boot Cabinet Top Air Sealing Fitting for 3.5” x 5” Net-Access Cabinet Opening
RFG6X8SMY	Raised Floor Air Sealing Grommet

PART 3 EXECUTION

3.01 GENERAL

A. Upon completion of work, a Registered Communications Distribution Designer (RCDD) shall submit as-built drawings to the Owner and Engineer.

B. Upon completion of work, the Contractor shall input the cabling data into the cable management software.

C. Install voice and data cable, an outlet, and a jack at each location designated on the Drawings.

D. Provide any necessary screws, anchors, clamps, tie wraps, distribution rings, miscellaneous grounding and support hardware, etc. necessary to facilitate the installation of the cable plant system.

E. Furnish any special installation equipment or tools necessary to properly complete the installation.

F. Do not roll or store cable reels without an appropriate underlay.

G. Failure to follow the appropriate guidelines may require the installer to provide the additional material and labor required to bring the installation back into alignment with the guidelines. This shall also apply to any and all damages sustained to the cables by the installer during the implementation.

H. Provide fire blocking at all fire-rated ceiling, wall, and floor penetrations.

I. Plug conduits where cabling has been installed in the main equipment room, backbone, and other cable entrance locations with re-enterable duct seal of flame-retardant putty.

J. Provide bushings on all conduit ends.

K. All wiring, materials, and equipment must be listed and labeled by an NRTL. To certify performance characteristics that meet ANSI/TIA-568 Standards, provide all Original Equipment Manufacturer (OEM) documentation to the Owner.

L. All techniques and fixtures used in the installation must minimize complexity and must allow for

easy maintenance of, and ready access to, all components for test measurements.

M. No self-tapping screws shall be used.

N. All parts shall be made of corrosion-resistant material, such as plastic, anodized aluminum, or brass.

O. All materials used in the installation shall be resistant to fungus growth and moisture deterioration.

P. To avoid corrosion caused by electrolysis between dissimilar metals under the environmental operating conditions specified, separate dissimilar metals with an inert dielectric material.

Q. All cable runs must be continuous from patch panel to the outlet location.

R. Electrical components (such as impedance matching devices) at outlets shall be located outside the faceplate and shall have a standard plug connection.

S. All empty innerduct or conduit shall include a non-corrosive pull-rope.

T. Turn all spare patch cables over to the Owner.

U. All of the pathways shown on the Drawings are suggested routes for the Contractor to use as guidelines. Prior to construction, the Contractor shall coordinate in the field with other trades to determine the exact feeder, tie, and riser backbone cabling pathways. In any case where the communication pathway must be removed and re-routed, due to conflicts with other trades with which the Contractor did not previously coordinate, the Contractor is responsible for all costs associated with the removal and relocation.

V. In all 23-inch cabinets and racks, provide reducer brackets that are the full length of the rack, to allow for the installation of 19-inch equipment.

3.02 2-POST & 4-POST RACKS

A. Before placing any racks, frames, or cabinets, verify that all required power, circuit breakers, building grounding electrode system access, and floor space is in accordance with the contract Drawings.

B. Where applicable, place each rack or enclosure to allow any floor tiles immediately adjacent to the rear and sides to be removed.

C. In spaces that have access flooring installed, attach all racks to the structural floor as follows:

1. Place the rack.
2. Drill through the access floor panel beneath the rack at the four anchor points.
3. Fasten the rack to the structural floor with 3/8-inch or larger threaded rod and appropriate anchors and hardware. Threaded rod should protrude no more than 2 inches above the base of the rack.

D. For sites without access flooring, fasten enclosures directly to the structural floor at the four anchor points provided by the manufacturer, using appropriate methods and materials to provide a secure, steadfast installation.

E. Fasten racks together at three or more evenly-spaced points along the adjoining side using manufacturer-provided or manufacturer-approved bolts, nuts, and lock-washers.

F. Horizontally stabilize all equipment racks and bays using materials and methods listed as appropriate for the intended use. Place horizontal stabilizing on at least the first and last racks in a bay and on every second rack. Maximum spacing between horizontal bracing shall be 48 inches.

G. On the front and rear of each rack and enclosure, place a machine-generated self-adhesive white label with the identifier, indicated on the Contract Drawings, in black 1-inch black block letters.

H. Assemble relay racks according to manufacturer's instructions. Before attaching the rack to the floor, verify that the equipment mounting rails are the proper size for the rack-mount equipment.

I. Attach all racks to the floor in four places using appropriate floor-mounting anchors.

J. Bond racks to the Secondary Bonding Busbar (SBB) or Mesh-BN using appropriate hardware provided by the Contractor. The ground shall meet local code requirements and shall be approved by the Authority Having Jurisdiction (AHJ).

K. In seismically-active areas, install additional bracing for racks as required by applicable codes and the recommendations of a licensed structural engineer.

L. Cable runway may be attached to the top of the rack, to deliver cables to the rack, but do not drill the rack to attach the runway. Use appropriate hardware from the cable runway manufacturer.

M. Evenly distributed and uniformly distribute the equipment load on the rack. Place large and heavy equipment towards the bottom of the rack. Secure all equipment to the rack with equipment mounting screws.

3.03 ENCLOSURES

A. Provide all components of the cabinet system (cabinet, front and rear doors, side panels, mounting rails, cable managers, power strips, and accessories) as specified elsewhere in this Section.

B. Position the cabinet so that the front and rear doors and the cabinet body (as applicable) can be fully opened without being obstructed by other building, storage, or architectural components.

C. Follow the manufacturer's installation instructions when securing the cabinet to the floor, wall, and backboard.

D. On floor-supported cabinets, the wheeled base must contact the floor. The wheeled base should not be removed or omitted from the installation.

E. If the cabinet is not attached to the wall, then the floor, shelf, or tabletop surface on which the cabinet is placed must be able to support the combined weight of the cabinet and the equipment it houses.

F. Do not attach the cabinet to gypsum wall board. The cabinet must be attached directly into studs through a ¾-inch (19 mm) plywood backboard. The cabinet may be attached to a masonry wall if the installer provides the hardware. Use included hardware or the appropriate hardware as defined by local code or the authority having jurisdiction. When installed, the top of the cabinet should be no more than 2.1 m (84 inches) above the finished floor.

G. Cables shall enter and exit the cabinet through conduit knockouts in the top and/or bottom of the cabinet. When cables pass through a conduit knockout but are not enclosed in conduit, use edge-protection grommets on conduit knockouts.

H. Before installing equipment in the cabinet:

1. Install and adjust to position all accessories, including vertical cable managers, power strips, equipment-mounting rails, fan and filter kits, lights, etc..
2. Verify that fans, lights, and power strips work prior.

I. If shelves are used, they may be installed with the equipment.

J. Provide a telecommunications bond for equipment in the cabinet. Attach a vertical busbar to the equipment mounting rails to provide electrical continuity from the equipment to the SBB or Mesh-BN through the enclosure.

3.04 HORIZONTAL AND VERTICAL CABLE MANAGEMENT

A. Place and install all horizontal and vertical wire and cable management devices and assemblies so as not to impede the efficient use of or connection to adjacent panels, enclosures, or equipment.

B. Upon completion of the task, replace all covers, doors, and panels that were removed during the installation.

C. Vertical Cable Management

1. Attach vertical cable managers to the side of the rack or frame according to the manufacturer's installation instructions and using the hardware provided.
2. When a single vertical cable manager is used between two racks or frames, attach the vertical cable manager to both racks or frames.
3. When more than one cable manager is used on a rack or frame or on a group of racks or frames, use the same make, style, and size of vertical cable manager.
4. The color of the cable managers must match the color of the racks or frames.
5. After cabling is complete, attach the doors to the cable managers in the closed position.

D. Horizontal Cable Managers

1. When more than one horizontal cable manager is used on a rack, frame, or cabinet, or on a group of racks, frames, or cabinets, use the same make and style cable manager.
2. The color of the cable managers must match the color of the racks or frames.
3. Attach horizontal cable managers to the rack, frame, or cabinet with four screws according to the manufacturer's installation instructions. Each cable manager should be centered in the allocated rack-mount space.
4. Place horizontal managers so that the number of ports (cables) they support will not exceed the cable fill capacity of the cable managers.
5. After cabling is complete, attach the covers to the cable managers in the closed position.
6. Install equipment rack horizontal cable and wire management panels directly adjacent to (above and below) all distribution enclosures, patch panels, and termination hardware in the rack as depicted in the appropriate project Drawings.

E. Install wall-mounted termination and connecting block wire and cable management devices so that they are plumb, square, and positioned as close as is practical to the locations depicted on the Contract Drawings.

3.05 ZONE ENCLOSURES

A. Wall-Mounted Passive, and Active Equipment Zone Enclosures

1. Install zone enclosures in compliance with the manufacturer's instructions.
2. Install enclosures square and plumb
3. Install enclosures away from obstructions so that the the door can be opened fully without being obstruction by other building, storage, or architectural components.
4. Mount zone enclosures at convenient working heights.
5. Secure zone enclosures, at all manufacturer-provided mounting points, using mechanical fasteners that are appropriate for the material on which the enclosure is being mounted.
6. Provide all blocking required to make sure that the enclosure can support the maximum design load.
7. Only route cable through manufacturer-supplied points.
8. Bond the enclosure to the TBB in accordance as instructed by the manufacturer.

B. Ceiling-Mounted Wireless Zone Enclosures

1. Attach the enclosure to the ceiling so that the access door can be fully opened without being obstructed by other building, storage, or architectural components.
2. Install the enclosure as close as is practical to the center of the cabling zone, as shown on the Drawings. Position the enclosure so that it can be accessed without moving furniture and so that disturbance of the workspace is minimized.
3. Install the enclosure where the ceiling space is of sufficient height.
4. Follow the manufacturer's installation instructions when securing the enclosure to the ceiling and when installing equipment.
5. Attach the enclosure to building structure with threaded rods. Do not use the drop-ceiling grid (T-bars) or tiles to support the enclosure, unless the enclosure is provided with brackets specifically for this purpose.
6. Secure the enclosure to building structure with 3/8-inch hardware or appropriate hardware defined by local code or the authority having jurisdiction.

    a. Auxiliary framing may be required to position the enclosure as desired.
    b. The body of the enclosure should be above the drop ceiling tiles.
    c. The access door of the enclosure should be flush with the drop ceiling grid.
    d. Seal cable ports with foam sealing kits according to the manufacturer's instructions for plenum ceilings used as air handling spaces.

C. Ceiling-Mounted Active and Passive Equipment Enclosures

1. Attach the enclosure to the ceiling so that the access door can be fully opened without being obstructed by other building, storage, or architectural components.
2. Install the enclosure as close as is practical to the center of the cabling zone as shown on the Drawings. Position the enclosure so that it can be accessed without moving furniture and so that disturbance of the workspace is minimized.
3. Install the enclosure where the ceiling space is of sufficient height.
4. Follow the manufacturer's installation instructions when securing the enclosure to the ceiling and when installing equipment.
5. Attach the enclosure to building structure with threaded rods. Do not use the drop-ceiling grid (T-bars) or tiles to support the enclosure, unless the enclosure is provided with brackets specifically for this purpose.
6. Secure the enclosure to building structure with 3/8-inch hardware or appropriate hardware as defined by local code or the authority having jurisdiction.

    a. Auxiliary framing may be required to position the enclosure as desired.
    b. The body of the enclosure should be above the drop ceiling tiles.
    c. The access door of the enclosure should be flush with the drop ceiling grid.
    d. Seal cable ports with foam sealing kits according to the manufacturer's instructions for plenum ceilings used as air handling spaces.

D. Consolidation Point Boxes

1. Position the consolidation point box where the tile over the enclosure can be fully opened without being obstructed by other building, storage, or architectural components.
2. Position the box as close as is practical to the center of the cabling zone, as shown on the Drawings. Position the enclosure so that it can be accessed without moving furniture and so that disturbance of the workspace is minimized.
3. Prior to installation make sure that the floor space provides sufficient depth for the enclosure.
4. Follow the manufacturer's installation instructions when securing the enclosure to the floor or raised floor pedestals and when installing equipment.
5. The body of the enclosure shall be below the raised floor tiles so that the floor tile above the enclosure can serve as the enclosure's cover and will be flush with the floor.
6. Seal cable ports with foam sealing ki(s according to the manufacturer's instructions for raised floor plenums used as air handling spaces.

3.06 AIR-SEALING GROMMETS

A. Select a location for installation where there are no obstacles.

B. Select a location for floor tile cutouts that are in compliance with the floor tile manufacturer's requirements.

C. When cutting the floor tile for placement of the enclosure, make sure that the location does not compromise the strength or integrity of the tile.

D. To ensure a pathway to ground to prevent the buildup of a electrostatic charge, secure the outer ring to the raised floor with the self-tapping screws provided.

E. Install grommets in compliance with the manufacturer instructions.

END OF SECTION

SECTION 27 1323

COMMUNICATIONS OPTICAL FIBER BACKBONE CABLING

PART 1 GENERAL

1.01 SUMMARY

A. This Section includes the specifications for:

1. The supply, delivery, supervision, coordination, and installation of equipment items specified herein and shown on drawings
2. The specifications for the incorporation of Owner Furnished Equipment (OFE)
3. The testing, documentation, and instructions for completing the Structured Cabling System
4. Products supplied but not installed under this section, including loose equipment specified herein, which is to be turned over to the Owner at the completion of this project

B. Owner Furnished Equipment (OFE)

1. Certain equipment may be identified as Owner Furnished Equipment (OFE). This OFE may presently be part of the Owner's system, or may be provided by the Owner, and will either be delivered to the Contractor's off-site construction facility, delivered to the Contractor's on-site secured storage area, or be installed on site by others, as appropriate, for incorporation into the system.

    a. Clean and inspect all OFE.
    b. Notify the Owner in writing of damage, defects, and the extent of repair or adjustment required for the OFE to meet the original specification.
    c. Service OFE only as directed by the Owner under the arrangements of a separate contract, and incorporate repaired or adjusted OFE into the system as if provided new, except for warranty coverage.

C. Related Drawings

1. T-Series drawings follow the specifications in this section.
2. Electrical drawings specify the electrical requirements.
3. Interior Design drawings specify the interior finishes, spatial relationships between items, and mounting heights.

D. What the Contractor Shall Provide and Install

1. The Contractor shall furnish and install telecommunications passive equipment, including:

    a. Backbone cable
    b. Splicing and terminations
    c. Testing
    d. Administration

2. Although such work is not specifically mentioned herein or on the drawings, the Contractor shall furnish and install all miscellaneous items, accessories, appurtenances, and devices incidental to or necessary for a sound, secure and complete installation, without claim for additional payment.
3. The Contractor shall provide system testing and demonstration, system documentation, and instruction of Owner personnel without claim for additional payment.

E. Errors or Omissions in Drawings or Documentation

1. If any errors or omissions appear in Drawings, Specifications, or other documents, the bidding Contractor shall notify the Engineer no later than ten (10) days prior to submitting the bid.
2. Should conflict occur in or between drawings and specifications, the bidding Contractor is deemed to have estimated the more expensive way of doing the work, unless the bidding Contractor has asked for and obtained written decision (addendum), before submission of the bid, as to which method or materials will be required.

F. Dimensions

1. Dimensions indicated are limiting dimensions.

a. Do not use equipment exceeding the dimensions indicated.
b. Do not use equipment or arrangements that reduce the required clearances or exceed the specified maximum dimensions.

1.02 REFERENCES

A. Requirements, Codes, and Standards

1. Design, manufacture, test, and install telecommunications cabling networks per the manufacturer's requirements and in accordance with latest revision of the NFPA-70 (National Electrical Code®), state codes, local codes, requirements of Authorities Having Jurisdiction (AHJs), and the following standards, including the most current revisions, addendums, and any Technical Service Bulletins (TSBs) released at the time of bid:

a. ANSI/NECA/BICSI 607 – Standard for Telecommunications Bonding and Grounding Planning and Installation Methods for Commercial Buildings
b. ANSI/BICSI 002 Data Center Design and Implementation Best Practices
c. ANSI/TIA 568 Series – Telecommunications Cabling Standards
d. ANSI/TIA-569 – Commercial Building Standard for Telecommunications Pathways and Spaces
e. ANSI/TIA-606 – Administration Standard for Commercial Telecommunications Infrastructure
f. ANSI/TIA-607 – Generic Telecommunications Bonding and Grounding (Earthing) for Customer Premises
g. ANSI/TIA-526 Series – Standard Test Procedures for Fiber Optic Systems
h. NECA/FOA 301– Installing and Testing Fiber Optic Cables
i. ANSI/TIA-942 – Telecommunications Infrastructure Standard for Data Centers
j. ISO/IEC 11801 – Generic Cabling for Customer Premises

B. Install cabling in accordance with the most recent edition of the following BICSI® Publications:

1. BICSI – Telecommunications Distribution Methods Manual
2. BICSI – Information Technology Systems Installation Manual
3. BICSI – Outside Plant Design Reference Manual

C. Applicability of Codes, Rules, and Regulations

1. Federal, state, and local codes, rules, regulations, and ordinances governing the work, are as fully part of the specifications as if herein repeated or hereto attached.
2. If the Contractor notes items in the drawings or the specifications, construction of which would be code violations, the Contractor should promptly call them to the attention of the Owner's Representative in writing.
3. Where the requirements of other Sections of the specifications are more stringent than applicable codes, rules, regulations, and ordinances, the specifications shall apply.

D. Manufacturers' Recommendations

1. Install all cabling and termination devices per the manufacturers' recommended installation practices for the applications warranties.

E. Definitions

1. AWG – American Wire Gauge – The standardized wire gauge system for the diameter of round, solid, nonferrous, electrically-conducting wire.
2. BBC – Bonding Backbone Conductor – A telecommunication bonding connection which interconnects telecommunications bonding backbones. Formerly known as the grounding equalizer.
3. BD – Building Distributor – A distributor in which the building backbone cables terminate and at which connections to the campus backbone cables may be made.
4. BN – Bonding Network – A set of interconnected conductive structures that provides a low impedance path for the associated telecommunications infrastructure.
5. CP – Consolidation Point – A connection facility within Cabling Subsystem 1 for interconnection of cables extending from building pathways to the equipment outlet.
6. EDA – Equipment Distribution Area – A space allocated for end equipment, including computer systems and telecommunications equipment.
7. EF – Entrance Facility – An entrance to a building for both public and private network service cables, including wireless that includes the entrance point of the building and continues to the entrance room or space.
8. ER – Equipment Room – An environmentally-controlled, centralized space for telecommunications equipment that serves the occupants of the building, considered distinct from a Telecommunications Room (TR) because of the nature or complexity of the equipment.
9. ESD – Electro Static Discharge – The sudden flow of electricity between two electrically-charged objects caused by contact, an electrical short, or dielectric breakdown.
10. HC – Horizontal Cross-connect – A group of connectors, such as patch panels or punch-down blocks, that allow horizontal, backbone, and equipment cabling to be cross-connected with patch cords or jumpers.
11. HDA – Horizontal Distribution Area – A space in a computer room where a Horizontal Cross-connect (HC) is located, and which may include LAN switches, Storage Area Network (SAN) switches, and Keyboard/Video/Mouse (KVM) switches for the end equipment located in the Equipment Distribution Areas (EDAs).
12. IC – Intermediate Cross-connect – A facility enabling the termination of different levels of backbone cabling and interconnection between them or equipment.
13. MC – Main Cross-connect – A facility enabling the termination of backbone cables and their connection to incoming services, other backbone cabling or equipment.
14. MDA – Main Distribution Area – The central point of distribution for the structured cabling system, which includes the Main Cross-connect (MC) and, when equipment areas are served directly from the MDA, may also include Horizontal Cross-connect (HC).
15. Mesh-BN – Mesh Bonding Network – A bonding network to which all associated equipment, such as cabinets, frames, racks, trays, and pathways, are connected using a bonding grid that is connected to multiple points on the common bonding network.
16. PBB – Primary Bonding Busbar – A busbar placed in a convenient and accessible location and bonded, by means of the Telecommunications Bonding Conductor (TBC), to the building's service equipment (power) ground. Formerly known as the Telecommunications Main Grounding Busbar (TMGB).
17. RBB – Rack Bonding Busbar – A busbar within a cabinet, frame, or rack.
18. RBC – Rack Bonding Conductor – A bonding conductor from the rack or Rack Bonding Busbar (RBB) to the Telecommunications Equipment Bonding Conductor (TEBC).
19. RU – Rack Unit – A unit of measure, compliant with EIA 310, used to describe the height of equipment intended for mounting on equipment rails. One RU is 1.75 inches (44.45 mm) high.
20. SBB – Secondary Bonding Busbar – A common point of connection for

telecommunications system and equipment bonding to ground, located in the distributor room. Formerly known as the Telecommunications Grounding Busbar (TGB).

21. TBB – Telecommunications Bonding Backbone – The conductor that interconnects the Primary Bonding Busbar (PBB) to the Secondary Bonding Busbar (SBB).
22. TBC – Telecommunications Bonding Conductor – A conductor that interconnects the telecommunications bonding infrastructure to the building's service equipment (power) ground. Formerly known as the bonding conductor for telecommunications.
23. TEBC – Telecommunications Equipment Bonding Conductor – A conductor that connects the Primary Bonding Busbar (PBB) or Secondary Bonding Busbar (SBB) to equipment racks or cabinets.
24. TO – Telecommunications Outlet – A connecting device, located in a work area, at which the horizontal cabling terminates.
25. TR – Telecommunications Room – An enclosed space for housing telecommunications equipment, cable terminations, and cross-connect cabling. It is the recognized location of the cross-connect between the backbone and horizontal facilities.
26. UBC – Unit Bonding Conductor – A bonding conductor from equipment or a patch panel to a Rack Bonding Conductor (RBC) or a Rack Bonding Busbar (RBB).
27. ZDA – Zone Distribution Area – A space where a zone outlet or consolidation point is located, between the horizontal and equipment distribution areas, that allows frequent reconfiguration and flexibility.

1.03 PERMITS, FEES, AND CERTIFICATES OF APPROVAL

A. If required, the Owner or Owner's authorized agent will make application for and pay for any building permits

1.04 SYSTEM DESCRIPTION

A. The Contractor will provide, install, and test a complete structured cabling system for the project's voice and data communications systems from the Telecommunications Outlet (TO) to the Telecommunications Room (TR), and between telecommunications spaces. The Contractor will provide and install all required components as identified below.

1. Backbone Cable

    a. Vertical and horizontal backbone cabling will consist of hybrid optical fiber cable installed from each TR to the ER.

2. Backbone Cabling Termination

    a. Provide fiber distribution enclosures at each end, sized for the number of fibers to be installed.
    b. Terminate with field-installable connectors or with fusion splicing of factory cable assemblies and modular connector panels.

3. Typical Equipment Room (ER)

    a. A typical ER will consist of the following equipment:

        1) Open racks and/or enclosures with vertical and horizontal wire management
        2) 24-port or 48-port patch panels for termination of the horizontal cables served from this room
        3) Fiber Distribution Enclosures (FDEs)
        4) Fire-resistant plywood installed on at least one (1) wall, at a height of 96 inches Above the Finished Floor (AFF) on which to install wall-mounted equipment
        5) A room-level or building-level Uninterruptible Power System (UPS)
        6) Rack-mounted Power Outlet Units (POUs)
        7) One or more racks or enclosures to house network servers and switch equipment

8) A Grounding and bonding system connected to the building's main grounding electrode system
9) A cable runway system, installed above the racks and enclosures, to support and manage the cabling that runs from the racks and enclosures to the equipment in the space, which shall be fitted with all accessories required to adequately support the installed cabling, such as waterfalls, support components, and bonding components.

4. Typical Telecommunications Room (TR)

a. A typical TR will consist of the following equipment:

1) One or more floor-mounted open racks, wall-mounted racks, or enclosures, which shall have horizontal and vertical cable management and, when floor-mounted racks are used, horizontal stabilization, which may be provided by the cable runway from the rack to the wall, though if this is insufficient, shall have supports fabricated by the Contractor
2) Termination hardware supporting all horizontal and backbone cabling
3) Rack-mounted FDEs for termination and interconnection of the optical fiber backbone
4) A room-level or building-level Uninterruptible Power Supply (UPS) system
5) A rack-mounted POU
6) Fire-resistant plywood installed on at least one (1) wall at a height of 96 inches AFF on which to install wall-mounted equipment
7) A grounding and bonding system connected to the building's main grounding electrode system
8) A cable runway system, installed above the racks and enclosures, to support and manage the cabling that runs from the racks and enclosures to equipment in the space, which shall be fitted with all accessories required to adequately support the installed cabling, such as waterfalls, support components, and bonding components.

5. Pathways and Raceways

a. Pathways and raceways are the support system for the infrastructure. All pathways and raceways shall conform to the standards referenced in this Section.
b. All horizontal and backbone cable shall be properly supported every 48 to 60 inches. Infrastructure support systems include, but may not be limited to the following:

1) Properly-supported cable trays and cable runway
2) Properly-supported conduits, inside or outside, above ground or underground
3) Non-continuous cable supports, which shall be spaced no more than 60 inches apart
4) Surface raceway systems that may consist of metallic or non-metallic raceways and boxes

6. Using a Combination of Cable Supports

a. The preferred method for providing pathways is to use a combination of cable tray and non-continuous cable supports.

1) Cable trays shall be used for main horizontal cable pathways on all levels from the ER and TR locations.
2) Cable trays shall be installed in the main corridors.
3) In areas of low cable density, use independently-supported non-continuous cable supports in lieu of the cable tray system.
4) All backbone cable shall also follow these cable tray pathways.

5) To allow for future maintenance and access, the primary cable routes shall be located over corridors.
6) To protect cable from damage and to provide a suitable aesthetic appearance, in areas where the cable may be exposed, such as in open ceiling rooms, conduit or surface raceway must be used instead of non-continuous cable supports.

1.05 SUBMITTALS

A. Engineer's Review

1. The Engineer's review of shop drawings or samples shall not relieve the Contractor of responsibility for any deviation from the contract documents.
2. With the shop drawings, the Contractor shall include an index sheet detailing all deviations from the contract documents, and will be held responsible for all deviations unless the Contractor has received written approval from the Engineer for the specific deviation, separate from general shop drawing approval.
3. The Engineer's review shall not relieve the Contractor from responsibility for errors or omissions in the shop drawings or samples.

B. General Component Data

1. For all products covered under this Section, the Contractor shall submit the following data for each component:

a. A Specification Section reference
b. The Manufacturer's name
c. The Manufacturer's model and part number

C. Fiber Cable

1. In addition to the general requirements above, the Contractor shall submit the following additional data:

a. Cable identification numbers
b. Cable specifications including quantity of fibers, material, insulation, jacket, wavelength, attenuation, diameter, bend radius, core, cladding, coating, buffering, weight, and color

D. Connectors

1. In addition to the general requirements above, the Contractor shall submit the following additional data:

a. Connector specifications including material, dimensions, attenuation, Near-End CrossTalk (NEXT) connection losses, ratings, and construction
b. A drawing of the equipment

E. Splicing and Terminations

1. In addition to the general requirements above, the Contractor shall submit splicing and terminating tools, materials, and methods.

F. Testing

1. In addition to the general requirements above, the Contractor shall submit the following additional data:

a. The equipment serial number
b. A graphic diagram documenting the test procedure, including all connectors, the light source (as applicable), the origin, and the destination of each cable tested

G. Test Results

1. The Contractor shall submit all test results.

1.06 QUALITY ASSURANCE

A. Standards for Materials and Equipment

1. The Contractor shall provide all materials, equipment, and installation in compliance with the latest applicable standards from ANSI, FCC, ASTM, EIA/TIA, IEEE, NEC, NFPA, NEMA, OSHA, REA, and UL.
2. Electronic equipment provided by the Contractor shall have the UL label where applicable.

B. Installer Qualifications

1. Registered Communications Distribution Designer (RCDD)

a. The Contractor must have at least (1) Registered Communications Distribution Designer (RCDD) as recognized by Building Industry Consulting Service International (BICSI.) The RCDD must be a full-time employee of the Contractor, and shall be responsible for compliance of the work with the referenced standards and guidelines. At the time of bid, the RCDD shall provide a professional resume and proof of current registration to the Engineer for approval. The RCDD shall be present during construction and all cable testing and shall have:

1) Knowledge of BICSI installation standards.
2) Knowledge of NEC standards.
3) Knowledge of ANSI/TIA standards.
4) Five (5) years of experience in the installation of optical fiber cables, including splicing, terminating, and testing, including single and multimode
5) Five (5) references for projects of equivalent scope, type, and complexity of work completed within the last five (5) years. – The Contractor shall submit, as proof, supporting documents and the names, addresses, and telephone numbers of the operating personnel who can be contacted regarding the installation of the system.
6) Certification by the termination equipment manufacturer as an installer

C. Other Installers

1. Products shall only be installed by qualified technicians certified by the manufacturers.

D. Compliance with Laws, Ordinances, and Codes

1. As applicable, electronic equipment provided shall have the UL label.
2. Comply in every way with the requirements of local laws and ordinances, the National Board of Fire Underwriters, and the National Electrical Code. Anything in the plans or specifications that does not strictly comply with the above laws, ordinances, and rules must be referred to the attention of the Engineer for a decision before proceeding. No change in the plans or specifications shall be made without full consent in writing of the Engineer.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Handling

1. To prevent damage, theft, soiling, and misalignment, protect equipment during transit, storage, and handling.

B. Storage

1. The contractor shall coordinate the secure storage of equipment and materials on site, or, if no on-site storage is available, shall provide their own secure storage at the contractor's expense.
    a. Do not store equipment where conditions fall outside the manufacturer's recommendations for environmental conditions.
    b. Do not install damaged equipment. Remove environmental conditions from the site and replace damaged equipment with new equipment.
    c. If off-site storage of materials is necessary, this shall be at the Contractor's expense.

1.08 COORDINATION

A. Installation Schedule
    1. The Contractor shall coordinate with all other trades. The Contractor will submit a schedule for the installation within 10 days of contract award.
        a. The schedule shall include delivery, installation, and testing for conformance to specific job completion dates.
        b. As minimum, the schedule shall provide dates for the start of demolition, the completion of demolition completion, the installation start date, the completion of riser cabling, the completion of testing and labeling, cutover, the completion of the final punch list, final inspection, and acceptance.

B. Meeting Attendance and Schedule Adherence
    1. The Contractor must attend all project-related meetings and adhere to the schedule set by the Project Manager.

C. Final Inspection
    1. The Contractor is required to notify the Engineer of a proposed appointment for Final Inspection at least 72 hours before the appointment.

D. Within five working days after the final inspection, the Contractor shall send final project documentation and warranty information to the Owner and Engineer. The final project documentation shall include, but may not be limited to:
    1. As-Built Drawings, in AutoCAD format, with legible outlet addresses and cable paths
    2. Outlet location spreadsheets
    3. Warranty paperwork
    4. A copy of the Final Inspection and Acceptance Signoff Sheet
    5. Photos of each ER and TR

1.09 PROJECT CONDITIONS

A. Project Environmental Requirements
    1. Seismic Safety
        a. Provide mechanical and electrical support for all installed equipment as required by all applicable local building codes for this installation's earthquake risk hazard zone and as recommended by Telcordia Specification GR-63.
        b. Anchor all equipment racks with suitable anchors that meet safety standards.
        c. Mount overhead devices with appropriate safety attachments as required.
        d. Where cabinets and racks are secured directly to the building, this shall be done in accordance with guidance provided by the Authority Having Jurisdiction (AHJ) or a structural engineer.
        e. Provide shock and vibration isolation of equipment and fixtures as required.

2. Fiber Optic Cable Safety

   a. The following warnings shall be posted on the job site:

      1) WARNING: PERMANENT EYE DAMAGE CAN RESULT FROM LOOKING DIRECTLY INTO A LIGHT BEAM GENERATED BY AN LED OR LASER SOURCE OR INTO THE END OF A CABLE FIBER CONNECTED TO ONE OR THESE SOURCES.
      2) CAUTION: LIGHT GENERATED BY THESE SOURCES MAY NOT BE VISIBLE, YET REMAIN HAZARDOUS TO THE EYE. LOOK FOR WARNING LABELS ON SOURCE DEVICES.

   b. Observe all warning signs on equipment and all written safety precautions in the equipment instruction and technical manuals.
   c. Always handle cable carefully to avoid personal injury. Care should be taken with individual fibers to prevent injury to the eyes or penetration of the fibers into the skin.

3. Hazardous Materials Prohibition

   a. The Contractor shall ensure that all materials used in the project are asbestos-free, unless specifically authorized in writing by the Owner.

   b. Applicable products shall comply with the European directives on the Restriction of Hazardous Substances (RoHS; 2002/95/EC) and Waste Electrical and Electronic Equipment (WEEE; 2002/96/EC).

B. Existing Conditions

1. Verify that all conditions on the project site are acceptable for the Work specified in this Section. Prior to bid opening, notify the Consulting Engineer in writing of any discrepancies, conflicts, or omissions. Otherwise, correct these issues at no additional cost to the Owner.
2. Continue to monitor the project site. If conditions develop that require a variance from the Specifications or Drawings, then immediately notify the Owner in writing. Otherwise, make recommendations, submit drawings showing how the Work may be installed, and upon approval, proceed with the necessary changes without additional cost to the Owner.

C. Record Drawings:

1. Keep a complete set of all telecommunications drawings in the job site office for demonstration of the actual installation of work specified in this Section.
2. Use this set of drawings for no other purpose.
3. Where any material, equipment, or system components are installed differently than what is shown on the drawings, indicate the differences clearly and neatly using ink or indelible pencil.
4. Upon completion of the project, submit the record set of drawings.

1.10 USE OF THE SITE

A. Where the Owner deems it necessary to place restrictions, use the site as directed by the Owner.

B. When proceeding with the work, do not interfere with the ordinary use of streets, aisles, passages, exits, or operations of the Owner. During the day, set up cones and barriers in hallways and walkways. Do not string cable down the hallways during normal hours.

C. Request a hazardous materials worksheet that identifies potentially-hazardous locations. Do not proceed with any work in locations where hazardous materials are known to be. Obtain

instructions from the Contractor's Project Manager on how and when to work in these areas.

D. Multiple times each day, each contractor shall remove all trash and debris from the site. Before leaving the room each day:

1. The Contractor shall replace all ceiling tiles that they have removed.
2. The Contractor shall place all furniture and equipment that they have moved back into its original location.
3. The Contractor shall return any equipment that they have disconnected to working order.
4. The Contractor's Job Foreman shall inspect all work locations to ensure that the rooms are clean and that all of the tasks described above have been done.
5. It is recommended that the Contractor inspect the site and take pictures to document the condition of the ceilings and walls.

1.11 CONTINUITY OF SERVICES

A. Take no action that will interfere with or interrupt the existing building services, unless previous arrangements have been made with the Owner's representative. Arrange all work to minimize shutdown time.

B. The Owner's personnel shall perform shutdown of operating systems. When shutdown of systems is required, the Contractor shall give three (3) days' advance notice.

C. Should building services be inadvertently interrupted:

1. The Job Foreman shall immediately notify the Project Manager of the accidental disruption of services, the remedy, and how long it will take to restore services.
2. The Contractor shall immediately furnish the labor, including overtime, the material, and the equipment necessary to promptly restore the interrupted service at no cost to the Owner.

1.12 WARRANTY

A. The Contractor shall provide the following warranties for the system and components.

1. Contractor Materials and Labor Warranty

   a. The Contractor shall provide system warranties, for a period specified in the contract documents, against faulty materials and defects in workmanship. The Contractor shall also honor any manufacturer warranties that exceed this period of time.

2. Manufacturer Component Warranty

   a. All components of the structured cabling system shall be free from manufacturing defects in material or workmanship, under normal and proper usage, for a minimum of twenty-five (25) years.

3. Manufacturer System Performance Warranty

   a. The permanent links of the structured cabling system will comply with the standards for optical fiber for end-to-end performance, as defined in ANSI/TIA-568 Telecommunications Standard, for a minimum of twenty-five (25) years.

4. Manufacturer Application Assurance Warranty

   a. The structured cabling system will be free from defects that prevent the operation of standards-based applications and protocols over optical fiber. The applications and protocols shall be those recognized by standards bodies IEEE, ANSI, and ATM Forum and sanctioned specifically for transmission over the specified medium as defined in ANSI/TIA-568, ***[***ISO IEC 11801***] –include only for***

international projects, and shall support current and future applications designed for data transmission over the permanent link channel, as defined in the ANSI/TIA-568 telecommunications standard, for a period of twenty-five years.

B. The Manufacturer shall bear the burden to replace or repair any defective products during the warranty period at their cost, including labor and materials.

C. The warranty period shall begin on the date of the Owner's Acceptance of the Work. Evaluation of quality and workmanship shall be solely by the Owner or the Owner's representatives.

1.13 OWNER INSTRUCTION

A. At the time of substantial completion, the Contractor shall submit the System Operation Manual and the Maintenance Data Manual, each neatly bound, with tabbed dividers between sections, and a title page with space for submittal stamps.

B. Maintenance Data Manual

1. The Maintenance Data Manual shall include:

a. A Table of Contents
b. The company name, address, telephone number, and contact name for system service or maintenance
c. A listing of all equipment and materials, with the names of the manufacturers and the model numbers or part numbers
d. Catalog data sheets that include the manufacturers' names, addresses, and telephone numbers
e. Product manufacturers' warranties and a typed one-year system warranty that explicitly covers all materials and labor
f. The manufacturers' service manuals for all major equipment items
g. Test documentation showing the results of source quality control tests, field quality control tests, acceptance testing, and certification
h. A recommended preventative maintenance schedule with:
i. References to the applicable pages in the manufacturer's maintenance manuals
j. Where inadequate information is provided by the manufacturer, the information necessary for proper maintenance

C. Electronic Submittal

1. In addition to hard copy submittals, the Contractor shall submit all files needed to produce the above submittals:
2. Transportation media shall be in Microsoft® structure on CD-ROM or USB flash drive
3. A Master File List, in text format, placed on each medium, with a short description of files in the submittal
4. Drawings, in AutoCAD R2010 or later drawing format (.DWG), that include all XREFs, fonts, and other drawing parts required for the drawings

a. **Note:** Drawing Exchange File Format (.DXF) is not acceptable.

5. Word processing files in MS Word 2007 format
6. Graphs and charts in MS Excel 2007 format
7. All graphic images required for the reproduction of the submittals included in the files in JPEG (.JPG) file format.
8. Manufacturers' data sheets, equipment manuals, and other documentation provided by the Manufacturers to the Contractor or documents that are similarly not otherwise available to the Contractor in electronic format shall be excluded from this requirement.

D. Keys

1. Submit three copies of all keys required for access to and operation of the systems.

1.14 COMMISSIONING

A. Furnish one initial set of product brochures and owner's manuals to the Owner for use during acceptance testing and equalization.

PART 2 PRODUCTS

2.01 GENERAL

A. In this section, certain products are specified by manufacturer and part number to establish a level of quality, performance, and consistency. To substitute other products would defeat this effort to the Owner's detriment. If no manufacturer or part number is specified for a part, then that part is generic, and the Contractor shall submit for approval a part that provides the performance specified herein.

B. All materials and products, including Owner Furnished Equipment (OFE), shall be:

1. Appropriate for the intended use
2. Recognized as such by a Nationally Recognized Testing Laboratory (NRTL) such as Underwriters Laboratories (UL), ETL SEMCO (ETL), the Canadian Standards Association (CSA), or the American National Standards Institute (ANSI)
3. Permitted for the application by the Authority Having Jurisdiction (AHJ)

C. Electrical components shall bear the UL or ETL label, and this listing shall apply to the entire assembly. Only systems and equipment that meet or exceed the level of quality and the capabilities stated in this document will be considered for acceptance.

D. All products shall be new, of the latest version at time of bid, and brought to the job site in the original manufacturer's packaging. Used equipment and damaged material will be rejected.

E. Any modifications to equipment to suit the intent of the specifications shall be performed in accordance with these requirements.

F. Cable lubricants specifically designed for installing communications cable may be used as needed to reduce pulling tension when pulling cable into conduit.

G. Take care during installation to prevent scratches, dents, chips, etc. Equipment with significant or disfiguring cosmetic flaws will be rejected.

H. All components will be approved by the Engineer and shall have the highest aesthetic value possible while providing the specified functionality. Hardware shall:

1. Be in compliance with the Construction Documents
2. Have fit and finish compatible with the existing surrounding structure
3. Be unobtrusive
4. Provide the required functionality

I. All work area termination hardware, including mounting boxes, faceplates, and outlets, shall match the existing wall surface color as closely as possible.

J. All copper and fiber products shall be from a single manufacturer so that a single performance

K. Fabricate custom-made equipment with careful consideration given to aesthetic, technical, and functional aspects of the equipment and its installation.

L. Provide products that are suitable for the intended use, including, but not limited to

environmental, regulatory, and electrical factors.

2.02 OPTICAL FIBER CABLES

A. Optical Fiber Strands

1. All optical fibers shall:

a. Be usable and shall meet required specifications
b. Be sufficiently free of surface imperfections and inclusions to meet the optical, mechanical, and environmental requirements of this specification
c. Consist of a doped silica core surrounded by a concentric glass cladding and have a matched clad design.
d. Be proof tested by the fiber manufacturer at a minimum of 100 kpsi (0.7 GN/m^2)
e. Be coated with a dual layer acrylate protective coating that is in physical contact with the cladding surface
f. Have a maximum attenuation value for each cabled fiber at 23˚C ± 5˚C on the original shipping reel

2. Graded Index (50/125 µm OM3)

a. The multimode fiber utilized in the OM3 optical fiber cable shall meet TIA-492AAAC-A, “Detail Specification for 850-nm Laser-Optimized, 50µm Core Diameter/ 125-µm Cladding Diameter Class Ia Graded-Index Multimode Optical Fibers.” The fibers shall have:

1) A core diameter of 50.0 ± 2.5 µm
2) Core non-circularity of no more than 5%
3) A cladding diameter of 125.0 ± 1.0 µm
4) Cladding non-circularity of no more than 1.0%
5) A core-to-cladding concentricity of no more than 1.0 µm
6) A coating diameter of 245 ± 10 µm
7) A refractive index core (graded index)
8) A numerical aperture of 0.200 ± 0.015
9) Maximum attenuation of 2.3 dB/km at 850 nm, 0.6 dB/km at 1300 nm, and 1.0 dB/km at 1301-1380 nm
10) IEEE 802.3ae performance that supports laser-based 10 Gigabit Ethernet (GbE) operation in the 10GBASE-SR/SW (850 nm) and 10GBASE-LX4 (1310 nm) at 300 m and 10GBASE-LRM (1310 nm) at 220 meters
11) A minimum LED bandwidth of 500/500 MHz•km at 850/1300 nm
12) Attenuation uniformity with no point discontinuities greater than 0.08 dB at either 850 nm or 1300 nm
13) Water peak attenuation with a coefficient at 1380 nm that does not exceed the coefficient at 1300 nm by more than 3.0 dB/km
14) Macrobend attenuation due to 100 turns of fiber around a 75 mm ± 2 mm diameter mandrel that does not exceed 0.05 dB at 850 nm or 1300 nm

3. Single-Mode (8.5/125 µm)

a. Single-mode fibers shall meet TIA-492CAAB, “Detail Specification for Class IVa Dispersion-Unshifted Single-Mode Optical Fibers with Low Water Peak,” and ITU recommendation TG.652, “Characteristics of Single-Mode Optical Fiber Cable.” The fibers shall have:

1) A core/cladding diameter (characterized) of 8.2 µm/125.0 µm ± 0.7 µm
2) Core-to-cladding concentricity of no more than 0.5 µm
3) Cladding non-circularity of no more than 1.0%
4) A coating diameter of 245 µm ± 5 µm
5) Attenuation of 0.34 dB/km at 1310 nm and 0.22 dB/km at 1550 nm

6) Attenuation uniformity with no point discontinuity greater than 0.05 dB at either 1310 nm or 1550 nm
7) Water peak attenuation at 1383 nm ± 3 nm that is no more than 0.31 dB/km
8) A cabled cutoff wavelength: (∂ccf) that is no more than 1260 nm
9) IEEE 802.3ae performance that supports laser-based Gigabit Ethernet (GbE) operation in the 10GBASE-LR (1300 nm) operating window at 10,000 m
10) A mode field diameter of 9.20 µm ± 0.40 µm at 1310 nm and 10.4 µm ± 0.8 µm at 1550 nm
11) Macrobend attenuation due to 100 turns of fiber around a 50 mm ± 2 mm diameter mandrel that does not exceed 0.05 dB at 1310 nm and 1550 nm.
12) A zero dispersion wavelength (∂o) of 1301.5 nm that is not more than ∂o at 1321.5 nm or less
13) A zero dispersion slope (So) of no more than 0.086 ps/(nm•km)
14) Maximum dispersion of no more than 3.2 ps/(nm•km) from 1285 nm through 1330 nm and less than 18 ps/(nm•km) at 1550 nm
15) A fiber curl with a curvature radius of no less than 4.0 m

B. Fiber Optic Cable Fire Ratings

1. Only OFCP-listed optical fiber backbone cable is acceptable for use on this project.

C. Fiber Optic Cable Termination

1. Where cables are installed, the 250 µm coated fibers contained in these cables may be terminated either by:
   a. Splicing of factory-terminated cable assemblies (“pigtails”)
   b. Individual fibers secured in a protective covering, such as an aramid-reinforced tube with connectors mated to the resulting assembly
2. Splicing shall be by the “fusion” method. Individual splice loss shall not exceed 0.3 dB.
3. Direct termination of 250 µm coated fibers is not permitted.

D. Fiber Optic Cable Features

1. The size and configuration of fiber optic cables shall be as shown on the Drawings.
2. The buffered fibers shall be grouped in 12-fiber subunits.
3. The fibers shall be stranded around a dielectric central member in the subunit.
4. Layered aramid yarns shall serve as the tensile strength member of the subunit.
5. To facilitate jacket removal, a ripcord may be applied between the aramid yarns and the subunit jacket.
6. For physical and environmental protection, the subunit jacket shall be extruded over the aramid yarns. The jacket shall:
   a. Be continuous and free from pinholes, splits, blisters, or other imperfections
   b. Have a consistent, uniform thickness
   c. Be smooth, as is consistent with the best commercial practice
7. The subunits shall be stranded around a dielectric central member, a ripcord shall be inserted beneath the outer jacket to facilitate jacket removal, and an outer jacket shall be extruded around the subunits.
8. An overall helically-wound interlocking metallic armor shall be provided, to surround the outer cable jacket, to which a listed outer jacket shall be applied.
9. The individual fibers shall be color-coded for identification.
   a. The optical fiber color coding shall be in accordance with EIA/TIA-598, “Optical Fiber Cable Color-Coding.”
   b. The coloring material shall be stable over the temperature range of the cable, shall

not be susceptible to migration, and shall not affect the transmission characteristics of the optical fibers.

c. Color-coded buffered fibers shall not adhere to one another.

10. The overall jacket for graded index cables as specified herein shall be aqua.
11. The overall jacket for single-mode cables as specified herein shall be yellow.

E. Fiber Optic Cable Part Numbers

1. The table below lists acceptable Panduit part numbers.

Part Number	Description
Armored	
FOPPX12Y	12-fiber OM3 10 GbE multimode OFCP (plenum) rated aluminum interlocking armored cable
FSPP912Y	12-fiber OS2 singlemode OFNP (plenum) rated indoor interlocking aluminum armored cable
Outdoor	
FOWNX12	12-fiber OM3 10 GbE multimode Gel-Free aluminum interlocking armored outdoor cable
FSWN912	12-fiber OS2 Singlemode Riser Gel-Free aluminum interlocking armored outdoor cable

2.03 OPTICAL FIBER CONNECTORS

A. Optical fiber connectors shall be compliant with TIA/EIA-604-10A (LC).

B. For graded-index optical fiber strands, connectors ***[Insert may or may not as appropriate for this project.]*** use a mechanical splice and index-matching gel for interfacing the field strand with a pre-polished fiber stub.

C. For 9/125 µm single-mode strands, fusion splicing of factory cable assemblies is required. Field polish connectors are permitted for use with OS1 and OS2.

D. Connectors must meet or exceed the performance criteria as stipulated in ANSI/TIA-568-C and must be manufactured with the following strain relief boots:

1. An aqua strain relief boot to indicate 50/125 µm multimode optical fiber
2. A blue strain relief boot to indicate single-mode optical fiber

E. Connectors shall use a precision zirconium ceramic ferrule.

F. Connectors shall have a typical insertion loss of 0.2 dB and a maximum insertion loss of 0.4 dB.

G. Connectors shall be ANSI/TIA-568 ***[for international projects, include: and ISO/IEC 11801 –]*** compliant.

H. Connectors shall be made by an ISO 9001 Certified Manufacturer.

I. Do not use crimp or screw-on fiber connectors.

J. The table below lists acceptable Panduit part numbers.

Part Number	Description
FLCSMCXAQY	LC 50/125µm OM3/OM4 multimode simplex connector, aqua boot
FLCSSCBUY	LC 9/125µm singlemode simplex fiber optic connector for 900µm tight buffered fiber installation

2.04 OPTICAL FIBER DISTRIBUTION ENCLOSURES

A. All Fiber Distribution Enclosures (FDEs) shall:

1. Be rack-mounted, metal enclosures with removable doors and panels at front and rear
2. Be designed for cable entry from the rear of the enclosure
3. Be equipped with appropriate means for physically securing the cables in place, and shall provide sufficient rings, saddles, and guides to ensure that all cables and strands are dressed in a neat and workmanlike manner and to maintain the required minimum bend radii for all changes in direction
4. Be equipped with an integral bonding lug or stud for securing the fiber strength member
5. Provide space for six or twelve inserts
6. Use modular snap-in coupler panels or factory-made cassettes
7. Have front and rear access panels be fitted with manufacturer-supplied labels for each enclosure, cable, and all termination positions
8. Have blank connector panels for all available positions, unless the housing is ordered with optical fiber adapters pre-installed
9. The table below lists acceptable Panduit part numbers.

Part Number	Description
FCE1U	Rack Mount Fiber Enclosure 1RU
FCE2U	Rack Mount Fiber Enclosure 2 RU
FWME2	Wall Mount Fiber Enclosure With 2 FAP Openings
FAPB	Blank FAP

2.05 OPTICAL FIBER CONNECTOR PANELS

A. A connector panel is a modular removable plate containing optical fiber connector adapters or copper jacks.

1. Optical Fiber Couplers

a. Optical fiber couplers shall be a modular unit of the same manufacture as the Fiber Distribution Enclosures, and shall have keyed openings on the front and rear to provide proper alignment of the connectors.
b. Couplers will be factory-installed to maintain an appropriate A-B orientation throughout the optical link.
c. Couplers will be aqua with ceramic alignment sleeves for 50 µm graded-index optical fiber and blue for single-mode.

B. Connector Panels

1. Connector panels shall:

a. Be manufactured from 16-gauge cold-rolled steel or injection molded polycarbonate for structural integrity
b. Be finished with a black powder-coat texture to match other hardware
c. Have a single mounting footprint
d. Be available with three, four, six, eight, twelve, or twenty-four connector adapters in each panel
e. Be both rack-mountable and wall-mountable
f. Be attached with two push-pull latches to allow for quick installation and removal
g. Be available with industry standard single-fiber and small form factor multi-fiber adapters, including the TIA/EIA-604-3A (SC), TIA/EIA-2 (ST) compatible, and TIA/EIA-604-10A (LC)
h. Include removable icons that identify the circuits, including blank, telephone, computer, CATV, video camera, satellite dish, or CAT 6, and in colors including blue, yellow, red, white, electric ivory, ash, green, purple, gray, black, brown, and orange

C. Blank Connector Panels

1. Blank connector panels shall be available to fill unused space in the housings. The blank connector panels shall be:

   a. Attached with at least two push-pull latches to allow for quick installation and removal
   b. Manufactured from injection molded polycarbonate
   c. Finished with a wrinkled black texture to match the housing

D. The table below lists acceptable Panduit part numbers.

Part Number	Description
FAP6WBUDLCZ	FAP w/6 LC Duplex Adapters (BU) Zirconia
FAP6WAQDLCZ	FAP w/6 LC 10 GbE Dupl mm Adapters (AQ) Zirconia

PART 3 EXECUTION

3.01 GENERAL

A. Upon completion of work, a Registered Communications Distribution Designer (RCDD) shall submit as-built drawings to the Owner and Engineer.

B. The Contractor shall input the cabling data into the cable management software.

C. Install all cables in accordance with project Drawings.

D. Provide any screws, anchors, clamps, tie wraps, distribution rings, miscellaneous grounding and support hardware, etc. needed to facilitate the installation of the cable plant system.

E. Furnish any special installation equipment or tools required to properly complete the installation.

F. Do not roll or store cable reels without an appropriate underlay.

G. Failure to follow the appropriate guidelines may require the installer to provide the additional material and labor required to bring the installation back into alignment with the guidelines. This shall also apply to any and all damages caused to the cables by the installer during the implementation.

H. Provide fire blocking at all fire-rated ceiling, wall, and floor penetrations.

I. Plug conduits where cabling has been installed in the main equipment room, backbone and other cable entrance locations with re-enterable duct seal of flame-retardant putty.

J. Provide bushings on all conduit ends.

K. All wiring, materials, and equipment must be listed and labeled by an NRTL. To certify that performance characteristics meet ANSI/TIA-568 Standards, provide all Original Equipment Manufacturer (OEM) documentation to the Owner.

L. All techniques and fixtures used in the installation must minimize complexity must allow for easy maintenance of, and ready access to, all components for test measurements.

M. No self-tapping screws shall be used.

N. All parts shall be made of corrosion-resistant material, such as plastic, anodized aluminum, or brass.

O. All materials used in the installation shall be resistant to fungus growth and moisture deterioration.

P. To avoid corrosion caused by electrolysis between dissimilar metals under the environmental operating conditions specified, separate dissimilar metals with an inert dielectric material.

Q. All cable runs must be continuous from patch panel to the outlet location.

R. All empty innerduct or conduit shall include a non-corrosive pull-rope.

S. All of the pathways shown on the drawings are suggested routes for the Contractor to use as guidelines. Prior to construction, the Contractor shall coordinate in the field with other trades to determine the exact feeder, tie, and riser backbone cabling pathways. In any case where the communication pathway must be removed and re-routed, due to conflicts with other trades with which the Contractor did not previously coordinate, the Contractor is responsible for all costs associated with the removal and relocation.

3.02 WIRING PRACTICES

A. Group and bundle all wiring by power level or signal type.

B. Where specific instructions are not given, perform all wiring in strict adherence to standard industry practices as described in the referenced Telecommunications Distribution Methods Manual (TDMM), and ANSI/TIA-568 standards.

C. Exercise care in wiring to avoid damaging the cables and equipment. Where conduit or chase nipples are not installed around cut outs or knockouts, use grommets.

D. Where wiring of different classifications share a common enclosure or junction box, provide metallic isolation barriers to completely electrically separate wiring groups.

E. Coordinate with tradespeople in the field, and employ proper installation techniques, including earthing and bonding and adequate ElectroMagnetic Compatibility (EMC). The following table lists the distances that should be maintained between power sources and copper data cabling to avoid ElectroMagnetic Interference (EMI).

Condition	<2kva	2-5kva	>5kva
Unshielded power lines or electrical equipment in proximity to open or non-metal pathways	6 inches	12 inches	24 inches
Unshielded power lines or electrical equipment in proximity to grounded metal conduit pathway	3 inches	6 inches	12 inches
Power lines enclosed in a grounded metal conduit (or equivalent shielding (in proximity to grounded metal conduit pathway)	2 inches	6 inches	6 inches
Transformers and Electric Motors	36 inches	36 inches	47 inches
Fluorescent lighting	12 inches	12 inches	12 inches

1. These guidelines apply to properly earth-bonded tray containing communications circuits in parallel with power circuits for a distance of 45 feet or more.
2. Communications circuits, contained in properly-bonded ventilated trough tray, shall not be placed in the same cable tray as power circuits.

F. All cables shall originate and terminate at active or passive devices. Cables shall not be spliced. Where several devices are in close proximity, use approved housing for connectors and adapters.

G. All cables terminated in a connection plate mounted in an enclosure shall be dressed to allow cables to be removed from the enclosure and shall be of sufficient length to allow for service or re-termination. The plate shall either set on the floor or freely swing clear.

H. All cables installed in vertical tray or chases shall be supported by means of appropriately-sized, vertical cable supports on every third floor. Do not use nylon cable ties.

I. Cable Installation in Conduit and Duct Banks

1. Through the entire length of all underground conduits, pull mandrel that is one size smaller than the conduit.
2. When pulling cable, use pulling lubrication.
3. During long or difficult runs, use a dynamometer to measure pulling tension. Place the dynamometer between the cable puller and the pull line to monitor pulling tension. Do not exceed the manufacturer's maximum pulling tension.
4. Apply pulling grips suitable for use with fiber optic cables to the ends of the cable. Consult the cable manufacturer to determine appropriate pulling grip and method of attachment. Use breakaway or fuse links at the pulling grip, And ensure that the correct “fuse pin” is installed in the fuse link.
5. To protect the cable ends until they are terminated, use cable caps (heat-shrinking type) to seal the ends of the cable.
6. Use cable blocks to facilitate the bending of cable. For bends between 5° and 45°, use a 45° cable block. For 45° to 90° bends, use a 90° cable block.
7. The bend radius for all cables shall conform to manufacturer’s specifications.

3.03 OPTICAL FIBER CABLE

A. Install the optical fiber backbone in a continuous length from the FDE in the MC to an FDE within each TR.

B. Throughout its length, run the backbone cable in appropriate, listed raceway.

C. Leave a 3 m long maintenance loop at each end of the link, neatly contained in the integral management rings and saddles in a “figure 8” loop at the rear of the FDE.

D. Throughout the length of the cable, maintain the minimum bend radius and pulling force recommended by the manufacturer and required by industry standards, both during installation and after termination and testing.

E. On each end, remove all outer jacket and strength member materials to expose the individual 900-micron buffering of the individual strands for a length of 0.5 m (18 inches).

F. On each end, hold the cable ends securely in place with the cable clamping accessories in each FDE.

G. Route individual strands in the rear of the FDE in a neat and orderly fashion, and place them so as not to create undue stress or micro bending of the strands.

3.04 OPTICAL FIBER CONNECTORS

A. Place optical fiber connectors, appropriate for the optical fiber type, on all strands in strict accordance with manufacturer instructions and industry standards.

B. Install a strain relief boot on all strands, extending over the 900-micron buffer.

C. Remove all strength members from the individual strands, cleanly cutting them at the end of the associated buffer tube.

D. Polish all connector end-faces to a Universal Positive Contact (UPC) profile.

E. Perform the installation in strict compliance with all manufacturer instructions.

3.05 FIBER DISTRIBUTION ENCLOSURES

A. Place optical FDEs as depicted on the Drawings.

B. Fasten all FDEs to the mounting rails, at the four corners of the enclosure at least, using manufacturer-supplied or manufacturer-approved fasteners.

C. Place each FDE in the equipment rack so that it is square and plumb and so that the front face of the FDE is as close as practical to the front face of the rack.

D. Install coupler modules in adequate numbers to support all terminated strands.

E. Fit all unused module spaces with blank plates.

F. To prevent the contamination of unused coupler module faces by airborne particulates, leave the dust caps on all unused faces in place.

G. Once you have finished installing the FDEs, replace all covers, doors, and panels that you removed during the installation.

H. On the front and rear of each enclosure, place a machine-generated, self-adhesive label with a white background and the FDE's identifier, as listed in submittals, in black 1/2-inch-high block letters.

3.06 CABLE BUNDLING MATERIALS

A. Secure all cable bundles with proper bundling or securing materials so as to ensure that the cable runs are securely held in place both vertically and horizontally.

B. Do not tighten bundling materials or securing devices so tightly that they deform the inherent cable geometry or construction.

C. Do not use cable ties or hook-and-loop tape to secure cable runs to other building systems such as electrical conduit, Electric Metallic Tube (EMT), sprinkler pipes, ceiling suspension members.

D. In environmental air-handling spaces, only use appropriately-listed materials.

3.07 SYSTEM ADMINISTRATION

A. Uniquely identify each component of the installed system by location, function, unit, and sub-unit.

B. Identify each location with a unique alphanumeric identifier.

C. Assign a unique alphanumeric identifier to each equipment enclosure in the building.

D. Identify each adapter module installed in each distribution or interconnect enclosure with an alphanumeric identifier.

E. Identify each conduit, tray, and pathway with a unique alphanumeric identifier.

F. Identify each optical fiber cable with a textual label that indicates its type, strand count, point of origin, and termination.

G. Supply a Cable Identification Matrix.

H. Supply all records in compliance with ANSI/TIA-606.

I. Provide a database that is Open DataBase Connectivity (ODBC) compliant for administration of the Structured Cabling System described in this Section.

3.08 IDENTIFICATION

A. Before installing or terminating the cabling, confirm all specific labeling requirements with the Owner or the Owner's Engineer.

B. Cables

1. Mark each backbone cable at each endpoint and at all intermediate pull and access points and junction boxes with a label that indicates the origination and destination identifiers, the sheath identifier, and the strand or pair range.

C. Fiber Distribution Enclosures (FDEs)

1. Mark each FDE with an adhesive label that indicates the range of circuits installed within it.
2. Label each port with the origination and destination grid identifier and the individual strand ID.
3. At each end of each cable, within 75 mm (3 inches) of the end of the sheath, place a self-laminating label that surrounds the outermost jacket and bears the appropriate cable identifier.
4. On each equipment enclosure, affix self-adhesive labels, bearing the enclosure's identifier in block characters, at the top center of the front and rear doors or faces.
5. In all enclosures, place a label directly adjacent to the shortest side of each adapter that bears that adapter's identifier. Rotate the characters on the labels to maintain a left to right, top to bottom orientation.

D. Conduits

1. Where exposed and accessible, place labels on conduits and pathways within 0.5 m (18 inches) of each end.
2. It is recommended that you also provide additional labeling every 3 m (10' feet) of exposed length.

3.09 FIELD QUALITY CONTROL

A. General Testing

1. Refer to Section 27 08 00 – Commissioning of Communications for complete testing specifications.

B. Manufacturer's Field Service

1. At the start of the installation, periodically as the Work progresses, and after completion, furnish the services of the manufacturer's technical representative at the job site as

needed to advise on every phase of the Work.

2. At minimum, furnish full-time attendance during the first three work days and at least once every week thereafter.
3. Furnish technical assistance to the Installer as required.

END OF SECTION

SECTION 27 1500

COMMUNICATIONS HORIZONTAL CABLING

PART 1 GENERAL

1.01 SUMMARY

A. This Section includes specifications for:

1. The supply, delivery, supervision, coordination, and installation of equipment items specified herein and shown on the Drawings
2. The specifications for the incorporation of Owner Furnished Equipment (OFE)
3. The testing, documentation, and instructions for completing the Structured Cabling System
4. Products supplied but not installed under this section, including loose equipment specified herein, which is to be turned over to the Owner at the completion of this project

B. Owner Furnished Equipment (OFE)

1. Certain equipment may be identified as Owner Furnished Equipment (OFE). This OFE may presently be part of the Owner's system, or may be provided by the Owner and will either be delivered to the Contractor's off-site construction facility, be delivered to the Contractor's on-site secured storage area, or be installed on site by others, as appropriate, for incorporation into the system.

    a. Clean and inspect all OFE.
    b. Notify the Owner in writing of damage, defects, and the extent of any repair or adjustment required for the OFE to meet the original specification.
    c. Service OFE only as directed by the Owner under the arrangements of a separate contract, and incorporate repaired or adjusted OFE into the system as if provided new, except for warranty coverage.

C. Related Drawings

1. T-Series drawings follow the specifications in this Section.
2. Electrical drawings specify the electrical requirements.
3. Interior Design drawings specify the interior finishes, spatial relationships between items, and mounting height details.

D. What the Contractor Shall Provide and Install

1. The Contractor shall furnish and install telecommunications passive equipment, including:

    a. Horizontal cable
    b. Termination hardware
    c. Communications outlets
    d. Intersystem connections
    e. Device connections
    f. Splicing and terminations
    g. Testing
    h. Administration

2. Although such work is not specifically mentioned herein or on the Drawings, the Contractor shall furnish and install all miscellaneous items, accessories, appurtenances, and devices incidental to or necessary for a sound, secure, and complete installation, without claim for additional payment.
3. The Contractor shall provide system testing and demonstration, system documentation,

and instruction of Owner personnel, without claim for additional payment.

E. Errors or Omissions in Drawings or Documentation

1. If any errors or omissions appear in Drawings, Specifications, or other documents, the bidding Contractor shall notify the Engineer no later than ten (10) days prior to submitting the bid.
2. Should conflict occur in or between Drawings and Specifications, the bidding Contractor is deemed to have estimated the more expensive way of doing the work, unless the bidding Contractor has asked for and obtained written decision (addendum) before submission of the bid as to which method or materials will be required.

F. Dimensions

1. Dimensions indicated are limiting dimensions.

a. Do not use equipment exceeding the dimensions indicated
b. Do not use equipment or arrangements that reduce the required clearances or exceed the specified maximum dimensions.

1.02 REFERENCES

A. Requirements, Codes, and Standards

1. Design, manufacture, test, and install telecommunications cabling networks per manufacturer's requirements and in accordance with latest revision of the NFPA-70 (National Electrical Code®), state codes, local codes, requirements of Authorities Having Jurisdiction (AHJs), and the following standards, including the most current revisions, addendums, and any Technical Service Bulletins (TSBs) released at the time of bid:

a. ANSI/NECA/BICSI 607 – Standard for Telecommunications Bonding and Grounding Planning and Installation Methods for Commercial Buildings
b. ANSI/BICSI 002 Data Center Design and Implementation Best Practices
c. ANSI/TIA 568 Series – Telecommunications Cabling Standards
d. TIA-569 – Commercial Building Standard for Telecommunications Pathways and Spaces
e. TIA-606 – Administration Standard for Commercial Telecommunications Infrastructure
f. TIA-607 – Generic Telecommunications Bonding and Grounding (Earthing) for Customer Premises
g. TIA-526 Series – Standard Test Procedures for Fiber Optic Systems
h. NECA/FOA 301– Installing and Testing Fiber Optic Cables
i. TIA-942 – Telecommunications Infrastructure Standard for Data Centers
j. ISO/IEC 11801 – Generic Cabling for Customer Premises

B. BICSI® Publications

1. Install cabling in accordance with the most recent editions of the following BICSI® publications:

a. BICSI – Telecommunications Distribution Methods Manual
b. BICSI – Information Technology Systems Installation Manual
c. BICSI – Outside Plant Design Reference Manual

C. Applicability of Codes, Rules, and Regulations

1. Federal, state, and local codes, rules, regulations, and ordinances governing the work are as fully part of the specifications as if herein repeated or hereto attached.
2. If the Contractor notes items in the Drawings or the Specifications, construction of which

would be code violations, the Contractor should promptly call them to the attention of the Owner's representative in writing.

3. Where the requirements of other sections of the specifications are more stringent than applicable codes, rules, regulations, and ordinances, the specifications shall apply.

D. Manufacturers' Recommendations

1. To maintain the applications warranties, install all cabling and termination devices using the manufacturers' recommended installation practices.

E. Definitions

1. AWG – American Wire Gauge – The standardized wire gauge system for the diameter of round, solid, nonferrous, electrically-conducting wire.
2. BBC – Bonding Backbone Conductor – A telecommunication bonding connection which interconnects telecommunications bonding backbones. Formerly known as the grounding equalizer.
3. BD – Building Distributor – A distributor in which the building backbone cables terminate and at which connections to the campus backbone cables may be made.
4. BN – Bonding Network – A set of interconnected conductive structures that provides a low impedance path for the associated telecommunications infrastructure.
5. CP – Consolidation Point – A connection facility within Cabling Subsystem 1 for interconnection of cables extending from building pathways to the equipment outlet.
6. EDA – Equipment Distribution Area – A space allocated for end equipment, including computer systems and telecommunications equipment.
7. EF – Entrance Facility – An entrance to a building for both public and private network service cables, including wireless, that includes the entrance point of the building and continues to the entrance room or space.
8. ER – Equipment Room – An environmentally-controlled, centralized space for telecommunications equipment that serves the occupants of the building, considered distinct from a Telecommunications Room (TR) because of the nature or complexity of the equipment.
9. ESD – Electro Static Discharge – The sudden flow of electricity between two electrically-charged objects caused by contact, an electrical short, or dielectric breakdown.
10. HC – Horizontal Cross-connect – A group of connectors, such as patch panels or punch-down blocks, that allow horizontal, backbone, and equipment cabling to be cross-connected with patch cords or jumpers.
11. HDA – Horizontal Distribution Area – A space in a computer room where a Horizontal Cross-connect (HC) is located, and which may include LAN switches, Storage Area Network (SAN) switches, and Keyboard/Video/Mouse (KVM) switches for the end equipment located in the Equipment Distribution Areas (EDAs).
12. IC – Intermediate Cross-connect – A facility enabling the termination of different levels of backbone cabling and interconnection between them or equipment.
13. MC – Main Cross-connect – A facility enabling the termination of backbone cables and their connection to incoming services, other backbone cabling, or equipment.
14. MDA – Main Distribution Area –The central point of distribution for the structured cabling system, which includes the Main Cross-connect (MC) and, when equipment areas are served directly from the MDA, may also include Horizontal Cross-connect (HC).
15. Mesh-BN – Mesh Bonding Network – A bonding network to which all associated equipment, such as cabinets, frames, racks, trays, and pathways, are connected using a bonding grid that is connected to multiple points on the common bonding network.
16. PBB – Primary Bonding Busbar – A busbar placed in a convenient and accessible location and bonded, by means of the Telecommunications Bonding Conductor (TBC), to the building's service equipment (power) ground. Formerly known as the Telecommunications Main Grounding Busbar (TMGB).
17. RBB – Rack Bonding Busbar – A busbar within a cabinet, frame, or rack.
18. RBC – Rack Bonding Conductor – A bonding conductor from the rack or Rack Bonding

Busbar (RBB) to the Telecommunications Equipment Bonding Conductor (TEBC).

19. RU – Rack Unit A unit of measure, compliant with EIA 310, used to describe the height of equipment intended for mounting on equipment rails. One RU is 1.75 inches (44.45 mm) high.
20. SBB – Secondary Bonding Busbar – A common point of connection for telecommunications system and equipment bonding to ground, located in the distributor room. Formerly known as the Telecommunications Grounding Busbar (TGB).
21. TBB – Telecommunications Bonding Backbone – The conductor that interconnects the Primary Bonding Busbar (PBB) to the Secondary Bonding Busbar (SBB).
22. TBC – Telecommunications Bonding Conductor – A conductor that interconnects the telecommunications bonding infrastructure to the building's service equipment (power) ground. Formerly known as the bonding conductor for telecommunications.
23. TEBC – Telecommunications Equipment Bonding Conductor – A conductor that connects the Primary Bonding Busbar (PBB) or Secondary Bonding Busbar (SBB) to equipment racks or cabinets.
24. TO – Telecommunications Outlet – A connecting device, located in a work area, at which the horizontal cabling terminates.
25. TR – Telecommunications Room – An enclosed space for housing telecommunications equipment, cable terminations, and cross-connect cabling. It is the recognized location of the cross-connect between the backbone and horizontal facilities.
26. UBC – Unit Bonding Conductor – A bonding conductor from equipment or a patch panel to a Rack Bonding Conductor (RBB) or a Rack Bonding Busbar (RBB).
27. ZDA – Zone Distribution Area – A space where a zone outlet or consolidation point is located, between the horizontal and equipment distribution areas, that allows frequent reconfiguration and flexibility.

F. PERMITS, FEES, AND CERTIFICATES OF APPROVAL

1. If required, the Owner or Owner's authorized agent will make application for and pay for any building permits. ***– Edit or Remove as necessary for the intended project***

G. SYSTEM DESCRIPTION

1. The Contractor will provide, install, and test a complete structured cabling system for the project's voice and data communications systems from the Telecommunications Outlet (TO) to the Telecommunications Room (TR), and between telecommunications spaces. The Contractor will provide and install all required components as identified below.

H. Horizontal Cabling

1. Horizontal cabling includes horizontal cable, telecommunications outlet/connectors in the Work Area (WA), mechanical terminations and patch cords or jumpers located in a Telecommunications Room (TR) or Telecommunications Enclosure (TE), and may incorporate Multi-User Telecommunications Outlet Assemblies (MUTOAs) and Consolidation Points (CPs).

I. Typical Equipment Room (ER)

1. A typical ER will consist of the following equipment:

    a. Open racks and/or enclosures with vertical and horizontal wire management
    b. 24-port or 48-port patch panels for termination of the horizontal cables served from this room
    c. Fiber Distribution Enclosures (FDEs)
    d. Fire-resistant plywood installed on at least one (1) wall, at a height of 96 inches Above the Finished Floor (AFF) on which to install wall-mounted equipment
    e. A room-level or building-level Uninterruptible Power Supply (UPS) system
    f. Rack-mounted Power Outlet Units (POU)

g. One or more racks or enclosures to house network servers and switch equipment
h. A grounding and bonding system connected to the building's main grounding electrode system
i. A cable runway system, installed above the racks and enclosures, to support and manage the cabling that runs from the racks and enclosures to the equipment in the space, which shall be fitted with all accessories required to adequately support the installed cabling, such as waterfalls, support components, and bonding components.

J. Typical Telecommunications Room (TR)

1. A typical TR will consist of the following equipment:

a. One or more floor-mounted open racks, wall-mounted racks, or enclosures, which shall have horizontal and vertical cable management and, when floor mounted racks are used, horizontal stabilization, which may be provided by the cable runway from the rack to the wall, though if this is insufficient, shall have supports fabricated by the Contractor
b. Termination hardware supporting all horizontal and backbone cabling
c. Rack-mounted FDEs for termination and interconnection of the optical fiber backbone
d. A room-level or building-level Uninterruptible Power Supply (UPS) system
e. A rack-mounted POU
f. Fire-resistant plywood installed on at least one (1) wall at 96 inches AFF on which to install wall-mounted equipment
g. A grounding and bonding system connected to the building's main grounding electrode system
h. A cable runway system, installed above the racks and enclosures, to support and manage the cabling that runs from the racks and enclosures to equipment in the space, which shall be fitted with all accessories required to adequately support the installed cabling, such as waterfalls, support components, and bonding components

K. Pathways and Raceways

1. Pathways and Raceways are the support system for the infrastructure. All pathways and raceways shall conform to the standards referenced in this Section.
2. All horizontal and backbone cable shall be properly supported every 48 inches to 60 inches. Infrastructure support systems include, but may not be limited to the following:

a. Properly-supported cable trays and cable runway
b. Properly-supported conduits, inside or outside, above ground or underground
c. Non-continuous cable supports, which shall be spaced no more than 60 inches apart
d. Surface raceway systems that may consist of metallic or non-metallic raceways and boxes

L. Using a Combination of Cable Supports

1. The preferred method for providing pathways is to use a combination of cable tray and non-continuous cable supports.

a. Cable trays shall be used for main horizontal cable pathways on all levels from the ER and TR locations.
b. Cable trays shall be installed in the main corridors.
c. In areas of low cable density, use independently-supported non-continuous cable supports in lieu of the cable tray system.
d. All backbone cable shall also follow these cable tray pathways.

e. Horizontal and auxiliary system cables shall be combed and independently bundled. Bundle ties shall be easily removed for the addition or removal of cables and shall be plenum rated.
f. To allow for future maintenance and access, the primary cable routes shall be located over corridors.
g. To protect cable from damage and to provide a suitable aesthetic appearance in areas where the cable may be exposed, such as in open-ceiling rooms, conduit or surface raceway must be used instead of non-continuous cable supports.

1.03 SUBMITTALS

A. Engineer's Review

1. The Engineer's review of shop drawings or samples shall not relieve the Contractor of responsibility for any deviation from the contract documents.
2. With the shop drawings, the Contractor shall include an index sheet detailing all deviations from the contract documents, and will be held responsible for all deviations, unless the Contractor has received written approval from the Engineer for the specific deviation, separate from general shop drawing approval.
3. The Engineer's review shall not relieve the Contractor from responsibility for errors or omissions in the shop drawings or samples.

B. General Component Data

1. For all products covered under this Section, the Contractor shall submit the following data for each component:

a. A Specification Section
b. The Manufacturer's name.
c. The Manufacturer's model and part number

C. Copper Cable and Patch Cords

1. In addition to the general requirements above, the Contractor shall submit the following additional data:

a. Cable identification numbers
b. Cable specifications including quantity of pairs, material, insulation, performance, attenuation, Near-End CrossTalk (NEXT), diameter, conductor size, jacket, weight, and color
c. The length of the patch cords
d. The connector type for the patch cords

D. Fiber Cable and Patch Cords

1. In addition to the general requirements above, the Contractor shall submit the following additional data:

a. Cable identification numbers
b. Cable specifications including quantity of fibers, material, insulation, jacket, wavelength, attenuation, diameter, bend radius, core, cladding, coating, buffering, weight, and color
c. The length of the patch cords
d. The connector type for the patch cords

E. Devices

1. In addition to the general requirements above, the Contractor shall submit the following additional data for outlets, cover plates, and fiber connectors:

a. The outlet specifications, including category rating, material, wiring, termination type, wire type, and color
b. The associated faceplate
c. A drawing of each device

F. Connecting Hardware

1. In addition to the general requirements above, the Contractor shall submit the equipment specifications for copper patch panels, fiber patch panels, and wiring blocks, including quantity of ports, material, dimensions, mounting, terminating devices and color.

G. Connectors

1. In addition to the general requirements above, the Contractor shall submit the following additional data:

a. Connector specifications, including material, dimensions, attenuation, NEXT connection losses, ratings, and construction
b. A drawing of the equipment

H. Splicing and Terminations

1. In addition to the general requirements above, the Contractor shall submit the splicing and terminating tools, materials, and methods.

I. Testing

1. In addition to the general requirements above, the Contractor shall submit the following additional data:

a. The equipment serial number
b. A graphic diagram documenting the test procedure, including all connectors, the light source (as applicable,) the origin, and the destination of each cable tested.

J. Test Results

1. The Contractor shall submit all test results.

1.04 QUALITY ASSURANCE

A. Standards for Materials and Equipment

1. The Contractor shall provide all materials, equipment, and installation in compliance with the latest applicable standards from ANSI, FCC, ASTM, EIA/TIA, IEEE, NEC, NFPA, NEMA, OSHA, REA, and UL.
2. Electronic equipment provided by the Contractor shall have the UL label where applicable.

B. Installer Qualifications

1. Registered Communications Distribution Designer (RCDD)

a. The Contractor must have at least one (1) Registered Communications Distribution Designer (RCDD) as recognized by Building Industry Consulting Service International (BICSI.) The RCDD must be a full-time employee of the Contractor, and shall be responsible for compliance of work with the referenced standards and guidelines. At the time of bid, the RCDD shall provide a professional resume and proof of current registration to the Engineer for approval. The RCDD shall be present during construction and all cable testing and shall have:

1) Knowledge of BICSI installation standards

2) Knowledge of NEC standards
3) Knowledge of ANSI/TIA standards
4) Five (5) years of experience in the installation of optical fiber cables, including splicing, terminating, and testing including single and multimode.
5) Three (3) years of experience in the installation of balanced twisted pair copper cables for voice and data distribution systems, including splicing, terminating, testing, and complete verification of compliance with ANSI/TIA cable standards
6) Five (5) references for projects of equivalent scope, type, and complexity of work completed within the last five (5) years. The Contractor shall submit, as proof, supporting documents and the names, addresses, and telephone numbers of the operating personnel who can be contacted regarding the installation of the system.
7) Certification by the termination equipment manufacturer as an installer

C. Other Installers

1. Products shall only be installed by qualified technicians certified by the manufacturers.

D. Provide all electronic equipment with the UL label when applicable.

E. Compliance with Laws, Ordinances, and Codes

1. As applicable, electronic equipment provided shall have the UL label.
2. Comply in every way with the requirements of local laws and ordinances, the National Board of Fire Underwriters, and the National Electrical Code. Anything in the plans or specifications that does not strictly comply with the above laws, ordinances, and rules must be referred to the attention of the Engineer for a decision before proceeding. No change in the plans or specifications shall be made without full consent, in writing, of the Engineer.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Handling

1. To prevent damage, theft, soiling, and misalignment, protect equipment during transit, storage, and handling.

B. Storage

1. The contractor shall coordinate the secure storage of equipment and materials on site, or, if no on-site storage is available, shall provide their own secure storage at the Contractor’s expense.

a. Do not store equipment where conditions fall outside the manufacturer's recommendations for environmental conditions.
b. Do not install damaged equipment. Remove environmental conditions from the site, and replace damaged equipment with new equipment.
c. If off-site storage of materials is necessary, this shall be at the Contractor’s expense.

1.06 COORDINATION

A. Installation Schedule

1. The Contractor shall coordinate with all other trades. The Contractor will submit a schedule for the installation within 10 days of contract award.

a. The schedule shall include delivery, installation, and testing for conformance to specific job completion dates.

b. At minimum, the schedule shall provide dates for the start of demolition, the completion of demolition, the installation start date, the completion of copper cabling, the completion of backbone cabling, the completion of testing and labeling, cutover, the completion of the final punch list, final inspection, and acceptance.

B. Meeting Attendance and Schedule Adherence

1. The Contractor must attend all project-related meetings and adhere to schedule set by the Project Manager.

C. Final Inspection

1. The Contractor is required to notify the Engineer of a proposed appointment for Final Inspection at least 72 hours before the appointment.
2. Within five working days after the final inspection, the Contractor shall send final project documentation and warranty information to the Owner and Engineer. The final project documentation shall include, but may not be limited to:

a. As-Built Drawings, in an AutoCAD format, with legible outlet address and cable paths
b. Outlet location spreadsheets
c. Warranty paperwork
d. A copy of the Final Inspection and Acceptance Signoff Sheet
e. Photos of each ER and TR

1.07 PROJECT CONDITIONS

A. Project Environmental Requirements

1. Seismic Safety

a. Provide mechanical and electrical support for all installed equipment as required by all applicable local building codes for this installation's earthquake risk hazard zone and as recommended by Telcordia Specification GR-63.
b. Anchor all equipment racks with suitable anchors that meet safety standards.
c. Mount overhead devices with appropriate safety attachments as required.
d. Where cabinets and racks are secured directly to the building, this shall be done in accordance with guidance provided by the Authority Having Jurisdiction (AHJ) or a structural engineer.
e. Provide shock and vibration isolation of equipment and fixtures as required.

2. Fiber Optic Cable Safety

a. The following warnings shall be posted on the job site:

1) WARNING: PERMANENT EYE DAMAGE CAN RESULT FROM LOOKING DIRECTLY INTO A LIGHT BEAM GENERATED BY AN LED OR LASER SOURCE OR INTO THE END OF A CABLE FIBER CONNECTED TO ONE OR THESE SOURCES.
2) CAUTION: LIGHT GENERATED BY THESE SOURCES MAY NOT BE VISIBLE, YET REMAIN HAZARDOUS TO THE EYE. LOOK FOR WARNING LABELS ON SOURCE DEVICES.

b. Observe all warning signs on equipment and all written safety precautions in the instruction and technical manuals.
c. Always handle cable carefully to avoid personal injury. Care should be taken with individual fibers to prevent injury to the eyes or penetration of the fibers into the skin.

3. Hazardous Materials Prohibition

a. The Contractor shall ensure that all materials used in the project are asbestos-free, unless specifically authorized in writing by the Owner.

b. Applicable products shall comply with the European directives on the Restriction of Hazardous Substances (RoHS; 2002/95/EC) and Waste Electrical and Electronic Equipment (WEEE; 2002/96/EC)

4. Existing Conditions

a. Verify that all conditions on the project site are acceptable for the Work specified in this Section. Prior to bid opening, notify the Consulting Engineer, in writing, of any discrepancies, conflicts, or omissions. Otherwise, correct these issues at no additional cost to the Owner.

b. Continue to monitor the project site. If conditions develop that require a variance from the Specifications or Drawings, then immediately notify the Owner in writing. Otherwise, make recommendations, submit drawings showing how the Work may be installed, and, upon approval, proceed with the necessary changes without additional cost to the Owner.

B. Record Drawings

1. Keep a complete set of all telecommunications drawings in the job site office for demonstration of the actual installation work specified in this Section.
2. Use this set of drawings for no other purpose.
3. Where any material, equipment, or system components are installed differently than what is shown on the drawings, indicate the differences clearly and neatly using ink or indelible pencil.
4. Upon completion of the project, submit the record set of drawings.

1.08 USE OF THE SITE

A. Where the Owner deems it necessary to place restrictions, use the site as directed by the Owner.

B. When proceeding with the work, do not interfere with the ordinary use of streets, aisles, passages, exits, or operations of the Owner. During the day, set up cones and barriers in hallways and walkways. Do not string cable down the hallways during normal hours.

C. Request a hazardous materials worksheet that identifies potentially-hazardous locations. Do not proceed with any work in locations where hazardous materials are known to be. Obtain instructions from the Contractor’s Project Manager on and when to work in these areas.

D. Multiple times each day, each contractor shall remove all trash and debris from the site. Before leaving the room each day:

1. The Contractor shall replace all ceiling tiles that they have removed.
2. The Contractor shall place all furniture and equipment that they have moved back into its original location.
3. The Contractor shall return any equipment that they have disconnected to working order.
4. The Contractor’s Job Foreman shall inspect all work locations to ensure that the rooms are clean and that all of the tasks described above have been done.
5. It is recommended that the Contractor inspect the site and take pictures to document the condition of the ceilings and walls.

1.09 CONTINUITY OF SERVICES

A. Take no action that will interfere with or interrupt existing building services, unless previous arrangements have been made with the Owner's representative. Arrange all work to minimize shutdown time.

B. The Owner's personnel shall perform shutdown of operating systems. When shutdown of systems is required, the Contractor shall give three (3) days advance notice.

C. Should building services be inadvertently interrupted:

1. The Job Foreman shall immediately notify the Project Manager of the accidental disruption of services, the remedy, and how long it will take to restore services.
2. The Contractor shall immediately furnish the labor, including overtime, the material, and the equipment necessary to promptly restore the interrupted service at no cost to the Owner.

1.10 WARRANTY

A. The Contractor shall provide the following warranties for the system and components.

1. Contractor Materials and Labor Warranty

a. The Contractor shall provide system warranties, for a period specified in the contract documents, against faulty materials and defects in workmanship. The Contractor shall honor any manufacturer warranties that exceed this period of time.

2. Manufacturer Component Warranty

a. All components of the structured cabling system shall be free from manufacturing defects in material or workmanship, under normal and proper usage, for a minimum of twenty-five (25) years.

3. Manufacturer System Performance Warranty

a. The permanent links of the structured cabling system will comply with the standards for balanced twisted pair and optical fiber for end-to-end performance, as defined in ANSI/TIA-568 Telecommunications Standard, for a minimum of twenty-five (25) years.

4. Manufacturer Application Assurance Warranty
5. The structured cabling system will be free from defects that prevent the operation of standards-based applications and protocols over balanced twisted pair and optical fiber. The applications and protocols shall be those recognized by standards bodies IEEE, ANSI, and ATM Forum and sanctioned specifically for transmission over the specified medium as defined in ANSI/TIA-568, ***[***ISO IEC 11801***] –include only for international projects***, and shall support current and future applications designed for data transmission over the permanent link/ channel, as defined in ANSI/TIA-568 telecommunications standard, for a period of twenty-five years.

B. The Manufacturer shall bear the burden to replace or repair any such defective products during the warranty period at their cost, including labor and materials.

C. The warranty period shall begin on the date of the Owner's Acceptance of the Work. Evaluation of quality and workmanship shall be solely by the Owner or the Owner’s representatives.

1.11 OWNER INSTRUCTION

A. At the time of substantial completion, the Contractor shall submit the System Operation Manual and the Maintenance Data Manual, each neatly bound, with tabbed dividers between sections, and a title page with space for submittal stamps.

B. Maintenance Data Manual

1. The Maintenance Data Manual shall include:

a. A Table of Contents

b. The company name, address, telephone number, and contact name for system service or maintenance
c. A list of all equipment and materials, with the names of the manufacturers and the model numbers or part numbers
d. Catalog data sheets that include the manufacturers' names, addresses, and telephone numbers
e. Product manufacturers' warranties and a typed one-year system warranty that explicitly covers all materials and labor
f. The manufacturers' service manuals for all major equipment items
g. Test documentation showing the results of source quality control tests, field quality control tests, acceptance testing, and certification
h. A recommended preventative maintenance schedule with:

1) References to the applicable pages in the manufacturer's maintenance manuals
2) Where inadequate information is provided by the manufacturer, the information necessary for proper maintenance

C. Electronic Submittal

1. In addition to hard copy submittals, the Contractor shall submit all files needed to produce the above submittals:

a. Transportation media shall be in Microsoft® structure on CD-ROM or USB flash drive
b. A Master File List, in text format, placed on each medium, with a short description of files in the submittal
c. Drawings, in AutoCAD R2010 or later drawing format (.DWG), that include all XREFs, fonts, and other drawing parts required for the drawings

1) **Note:** Drawing Exchange File Format (.DXF) is not acceptable

d. Word processing files in MS Word 2007 format
e. Graphs and charts in MS Excel 2007 format
f. All graphic images required for the reproduction of the submittals included in the files in JPEG (.JPG) file format
g. Manufacturers' data sheets, equipment manuals, and other documentation provided by the Manufacturers to the Contractor or documents that are similarly not otherwise available to the Contractor in electronic format shall be excluded from this requirement.

D. Keys

1. Submit three copies of all keys required for access to and operation of the systems.

1.12 COMMISSIONING

A. Furnish one initial set of product brochures and owner's manuals to the Owner for use during acceptance testing and equalization.

PART 2 PRODUCTS

2.01 GENERAL

A. In this section, certain products are specified by manufacturer and part number to establish a level of quality, performance, and consistency. To substitute other products would defeat this effort to the Owner's detriment. If no manufacturer or part number is specified for a part, then that part is generic, and the Contractor shall submit for approval a part that provides the performance specified herein.

B. All materials and products, including Owner Furnished Equipment (OFE), shall be:

1. Appropriate for the intended use
2. Recognized as such by a Nationally Recognized Testing Laboratory (NRTL) such as Underwriters Laboratories (UL), ETL SEMCO (ETL), the Canadian Standards Association (CSA) or the American National Standards Institute (ANSI)
3. Permitted by the Authority Having Jurisdiction (AHJ)

C. Electrical components shall bear the UL or ETL label, and this listing shall apply to the entire assembly. Only systems and equipment that meet or exceed the level of quality and the capabilities stated in this document will be considered for acceptance.

D. All products shall be new, of the latest version at time of bid, and brought to the job site in original manufacturer's packaging. Used equipment and damaged material will be rejected.

E. Any modifications to equipment to suit the intent of the specifications shall be performed in accordance with these requirements.

F. Cable lubricants specifically designed for installing communications cable may be used as needed to reduce pulling tension when pulling cable into conduit.

G. Take care during installation to prevent scratches, dents, chips, etc. Equipment with significant or disfiguring cosmetic flaws will be rejected.

H. All components will be approved by the Engineer and shall have the most aesthetic value possible while maintaining specified functionality. Hardware shall:

1. Be in compliance with the Construction Documents
2. Have fit and finish compatible with the existing surrounding structure
3. Be unobtrusive
4. Provide the required functionality

I. All work area termination hardware, including mounting boxes, faceplates, and outlets, shall match the existing wall surface color as closely as possible.

J. All copper and fiber products shall be from a single manufacturer so that a single performance warranty covers all applications on vertical and horizontal links.

K. Fabricate custom-made equipment with careful consideration given to aesthetic, technical, and functional aspects of the equipment and its installation.

L. Provide products that are suitable for the intended use, including, but not limited to environmental, regulatory, and electrical factors.

2.02 MODULAR PATCH PANELS

A. Flush mount modular patch panels shall consist of a metal panels with molded rear snap-in faceplates.

B. Patch Panels shall accept all Mini Com modules for UTP, STP, and fiber or A/V applications and shall mount to standard 19” racks.

C. Patch panels shall be available in 24-port and 48-port standard density.

D. Select styles shall be available in white.

E. Flush mount patch panels shall be easy to identify with pre-numbered ports.

F. Angled patch panels shall be designed at an optimum angle to help route the cable.

G. Ultimate ID® Patch Panels shall comply with the latest TIA/EIA-606 labeling standard by providing labeling capabilities and various configurations.

H. Panduit Design Makes:

Part Number	Description
UICMPPA48BLY	2U, 48-Port, Mini-Com, Angled
CPPA24FMWBLY	1U, 24-Port, Mini-Com, Angled

2.03 HORIZONTAL UTP CABLE

A. Horizontal cabling shall be:

1. CMP- listed, 100 ohm, 23 AWG, 4-pair, Unshielded Twisted Pair (UTP)
2. In compliance with ANSI/TIA-568 for Category 6 / ISO Class E 6A / ISO Class EA performance, with swept frequency testing to at least 500 MHz

B. The outermost jacket must be indelibly printed by the manufacturer with the name of the manufacturer, the UL rating, and incremental footage markings.

C. For Cat 6A cables, all four pairs shall be surrounded by a metallic tape, cut into segments to combat the effects of alien crosstalk.

D. Horizontal UTP Part Numbers

1. The table below lists acceptable Panduit part numbers.

Part Number	Description
PUP6AM04BU-UG	Category 6A, 4-pair, 23 AWG, U/UTP, plenum, (CMP), Blue
PUP6004BU-UY	Category 6, 4-pair, 23 AWG, U/UTP, plenum, (CMP), Blue

2. The table below lists acceptable General Cable part numbers.

Part Number	Description
7132849	Category 6A, 4-pair, 23 AWG, U/UTP, plenum, (CMP), Blue
7131900	Category 6, 4-pair, 23 AWG, U/UTP, plenum, (CMP), Blue

2.04 FACEPLATES AND JACKS

A. UTP Jacks

1. UTP Jacks shall:

a. Be flush-mount eight-pin, eight conductor (8P8C) modular jacks
b. Have an Insulation Displacement Connector (IDC) on the rear
c. Provide color-coding for both T568A and T568B wiring schedules
d. Be universal in design
e. Be in compliance with the intermateability standard IEC 60603-7 for backward compatibility
f. Meet ANSI/TIA-568 requirements for Category 5e, 6 and 6A connecting hardware
g. Must accept 2-pair, 3-pair, or 4-pair modular plugs without damage to the outer jack contacts

B. Jack Part Numbers

1. The table below lists acceptable Panduit part numbers.

Part Number	Description
CJ6X88TGRD	Mini-Com Module, Cat 6A, UTP, 8 pos 8 wire, Universal, Red, TG Style
CJ6X88TGBU	Mini-Com Module, Cat 6A, UTP, 8 pos 8 wire, Universal, Blue, TG Style
CJ6X88TGBL	Mini-Com Module, Cat 6A, UTP, 8 pos 8 wire, Universal, Black, TG Style
CJ688TGBL	Mini-Com Module, Cat 6, UTP, 8 pos 8 wire, Universal, Black, TG Style
CJ688TGBU	Mini-Com Module, Cat 6, UTP, 8 pos 8 wire, Universal, Blue, TG Style
CJ5E88TGBL	Mini-Com Module, Cat 5e, UTP, 8 pos 8 wire, Universal, Black, TG Style

C. Faceplates

1. Faceplates shall:

a. Be single-gang or double-gang
b. Of the same manufacturer as the jacks
c. Have the capability for integral labeling and identification
d. Provide capacity for a maximum of:

1) Six individual jacks for single-gang applications
2) Up to 12 individual jacks for double-gang applications

D. Faceplate Part Numbers

1. The table below lists acceptable Panduit part numbers.

Part Number	Description
CFFP4BL	Furniture Faceplate, 4 port, Black
CFFPL4BL	Furniture Faceplate, with label, 4 Port, Black
CFFPHM4BL	Furniture Faceplate, 4 Port, Herman Miller, Black
CFPE2WHY	Executive Faceplate Single Gang, 2-port
CFPE6WHY	Executive Faceplate Single Gang, 6-port

2.05 SURFACE MOUNT BOXES

A. *MINI-COM®* Low Profile Surface Mount Boxes shall be 1, *2,* 4, 6 and 12 port low profile surface mount boxes with a 28 mm (1.1") maximum height.

1. All connections (with exception of the 12 port low profile box) shall exit one side of the box, parallel to the wall.
2. The boxes shall be capable of mounting with screws, adhesive, and/or magnets.
3. The 2 port boxes shall include a removable blank for addition of a second port.
4. The 4, 6 and 12 port boxes shall include breakouts for use with *PAN-WAY*™ surface raceway and cable tie slots at each raceway entry point to provide strain relief on incoming cables.
5. The 4 (except low profile 4), 6, and 12 port boxes shall include tamper resistant screws that securely fasten the cover to the base and are concealed by screw covers and labels.
6. Boxes with spring shuttered doors also available in 1, 2, 3, 4 and 6 ports. 3, 4 and 6 ports shall include breakouts for use with Pan-Way and include a tamper resistant screw to fasten cover to the base.
7. Each box shall accept individual connector modules that can be individually inserted

and removed as required.

B. *MINI-COM*® Fiber/Multi-Media Surface Mount Boxes shall be 6 and 12 port surface mount boxes with all connections exiting one side of the box, parallel to the wall.

1. The 6 and 12 port boxes shall contain a “captive” fiber spool that maintains a minimum 25.4 mm (1”) bend radius.
2. The 6 and 12 port boxes shall store up to 24 meters of buffered optical fiber.
3. Ultimate ID box available in 12 ports with a figure 8 spool.
4. The boxes shall be capable of mounting with screws, adhesive, and/or magnets.
5. The boxes shall include breakouts for use with *PAN-WAY*™ surface raceway on three sides and cable tie slots at each raceway entry point to provide strain relief on incoming cables.
6. The boxes shall include tamper resistant screws that securely fasten the cover to the base and are concealed by screw covers and labels.
7. Each box shall accept individual connector modules that can be individually inserted and removed as required.

C. Surface Mount Boxes part numbers.

1. The table below lists acceptable Panduit part numbers.

Part Number	Description
UICBX2WH-A	2 port box, White
UICBX4WH-A	4 port box w/adjustable mounting tabs for modular furniture

2.06 FACTORY-TERMINATED CABLE ASSEMBLIES

A. All cable assemblies will be constructed and tested at the manufacturer’s facilities.

B. Unshielded Twisted Pair (UTP) cable assemblies shall be:

1. Constructed using listed, 10 ohm, 23 AWG, 4-pair, Unshielded Twisted Pair cabling, of a 4+0 FEP construction, compliant with ANSI/TIA-568 for Category 6 and 6A performance and ETL verified for performance, with swept frequency testing to at least 500 MHz
2. Of the lengths and configurations indicated on the Drawings
3. Bundled using appropriate means to create a single unit
4. Terminated to 8P8C jack assemblies at each end

C. The 8P8C jack assemblies for factory-terminated cable assemblies shall be:

1. 8P8C modular, exceeding ANSI/TIA- 568 requirements for Category 6 and 6A connecting hardware and be ETL verified for Category 6 and 6A performance
2. Ganged together to create a modular cassette arrangement for insertion into rack-mountable panel assemblies

D. The assembly and each link therein will be individually identified and bear an appropriate, ANSI/TIA-606-C compliant label.

2.07 CORDAGE

A. Unshielded Twisted Pair (UTP) Cordage

1. Patching, equipment, and station cords shall be factory manufactured and shall be in compliance with Category 6 and 6A for channel performance. The use of field-manufactured cordage is not permitted.
2. All cords shall be constructed of four twisted pair of 24 AWG stranded conductors terminated to industry standard 8P8C modular plug at both ends.

3. Cordage shall be color-coded by service type (Voice, Data, Video, etc.). Colors shall be coordinated with and approved by the Owner.
4. Wiring schedule shall match that of patch panels and outlets.
5. Cordage shall be of the same manufacturer as modular jacks, patch panels, and connecting/termination blocks.
6. Station cords shall be a mixture of 1’-0” long, for Wireless, and the remaining station cords shall be 25% 5’-0”, 50% 7’-0” and 25% 10’-0”.
7. Equipment cords shall be a mixture of 50% 5’-0” and 50% 7’-0”.
8. The table below lists acceptable Panduit part numbers.

Part Number	Description
UTP6ASD1RD	Category 6A UTP Patch Cord, Red, 1’-0”
UTP6ASD5RD	Category 6A UTP Patch Cord, Red, 5’-0”
UTP6ASD7RD	Category 6A UTP Patch Cord, Red, 7’-0”
UTPSP5BUY	Category 6 UTP Patch Cord, Blue, 5’-0”
UTPSP7BUY	Category 6 UTP Patch Cord, Blue, 7’-0”
UTPSP10BUY	Category 6 UTP Patch Cord, Blue, 10’-0”

B. CABLE BUNDLING MATERIALS

1. Provide hook and loop tape that is at least 0.5 inches wide, of a length equal to 150% of the circumference of the cable bundle.
2. Do not use tie wraps on this project.
3. When used in areas considered environmental air spaces, all bundling materials must be appropriately listed.
4. The table below lists acceptable Panduit part numbers.

Part Number	Description
HLS-75R0	Hook & Loop Roll, 75'L (22.9m), .75"W (19.1mm), Black
HLS-15R0	Hook & Loop Roll, 15'L (4.6m), .75"W (19.1mm), Black
HLB2S-C0	Hook & Loop Stacked Strip Ties, 7.0"L (178mm), .75"W (19.1mm), 100 pcs, Black
HLC3S-X0	Hook & Loop Tie, Cinch, 12.0"L (305mm), .75"W (19.1mm), Black
HLM-15R0	Hook & Loop Roll, 15' L(4.6m), .33"W (8.4mm), Black
HLS1.5S-X0	Hook & Loop Tie, Strip, 6.0"L (152mm), .75"W (19.1mm), Black
HLS3S-X0	Hook & Loop Tie, Strip, 12.0"L (305mm), .75"W (19.1mm), Black
HLSP1.5S-X0	Hook & Loop Tie, Plenum Strip, 6.0"L (152mm), .75"W (19.1mm), Black
HLT2I-X0	Hook & Loop Tie, Loop Style, 8.0"L (203mm), .50"W (12.7mm), Black
HLTP2I-X0	Hook & Loop Tie, Plenum Loop Style, 8.0"L (203mm), .50"W (12.7mm), Black
TTS-35RX0	Hook and Loop Roll, 10 Roll-Pack, Low Profile, 35'L (10.7m), .75"W (19.1mm), Black
PLT3I-C	Cable Tie, 11.4"L (290mm), Intermediate, Nylon, Natural
PLT3S-C2	Cable Tie, 11.5"L (292mm) Standard, Nylon, Red
PLT8LH-C0	Cable Tie, 27.6"L (701mm), Light-Heavy, Weather Resistant, Black
PLT4S-M30	Cable Tie, 14.5"L (368mm), Standard, Heat Stabilized, Black
PLT3S-M2	Cable Tie, 11.5"L (292mm) Standard, Nylon, Red
PLT4I-M	Cable Tie, 14.5"L (368mm), Intermediate, Nylon, Natural

PART 3 EXECUTION

3.01 GENERAL

A. Upon completion of the work, a Registered Communications Distribution Designer (RCDD) shall submit as-built Drawings to the Owner and to the Engineer.

B. The Contractor shall input the cabling data into the cable management software.

C. Install voice and data cable, an outlet, and a jack at each location designated on the Drawings.

D. Provide any required screws, anchors, clamps, tie wraps, distribution rings, miscellaneous grounding and support hardware, etc. needed to facilitate the installation of the cable plant system.

E. Furnish any special installation equipment or tools necessary to properly complete the installation.

F. Do not roll or store cable reels without an appropriate underlay.

G. Failure to follow the appropriate guidelines may require the installer to provide additional material and labor required to properly rectify the situation. This shall also apply to any and all damages caused to the cables by the installer during the implementation.

H. Provide fire blocking at all fire rated penetrations.

I. Plug conduits where cabling has been installed in the main equipment room, backbone, and other cable entrance locations with re-enterable duct seal of flame retardant putty.

J. Provide bushings on all conduit ends.

K. All wiring, materials, and equipment must be listed and labeled by an NRTL. To certify that performance characteristics meet ANSI/TIA-568 Standards, provide all Original Equipment Manufacturer (OEM) documentation to the Owner.

L. All techniques and fixtures used in the installation must minimize complexity and must allow for easy maintenance of, and ready access to, all components for test measurements.

M. No self-tapping screws shall be used.

N. All parts shall be made of corrosion-resistant material, such as plastic, anodized aluminum, or brass.

O. All materials used in installation shall be resistant to fungus growth and moisture deterioration.

P. To avoid corrosion caused by electrolysis between dissimilar metals under the environmental operating conditions specified, separate dissimilar metals with an inert dielectric material.

Q. All cable runs must be continuous from patch panel to the outlet location.

R. Place electrical components at outlets (such as impedance matching devices) outside the faceplate using a standard plug connection.

S. All empty innerduct or conduit shall include a non-corrosive pull-rope.

T. Turn all spare patch cables over to the Owner.

U. All of the pathways shown on the drawings are suggested routes for the Contractor to use as guidelines. Prior to construction, the Contractor shall coordinate in the field with other trades to

determine the exact feeder, tie, and riser backbone cabling pathways. In any case where the communication pathway must be removed and re-routed, due to conflicts with other trades with which the Contractor did not previously coordinate, the Contractor is responsible for all costs associated with the removal and relocation.

3.02 WIRING PRACTICES

A. Group and bundle all wiring by power level or signal type.

B. Where specific instructions are not given, perform all wiring in strict adherence to standard industry practices as described in the referenced Telecommunications Distribution Methods Manual (TDMM), and ANSI/TIA-568 standards.

C. Exercise care in wiring to avoid damaging the cables and equipment. Where conduit or chase nipples are not installed around cutouts or knockouts, use grommets.

D. Where wiring of different classifications share a common enclosure or junction box, provide metallic isolation barriers to completely electrically separate wiring groups.

E. Coordinate with tradespeople in the field, and employ proper installation techniques, including earthing and bonding and adequate ElectroMagnetic Compatibility (EMC).The following table lists the distances that should be maintained between power sources and copper data cabling to avoid ElectroMagnetic Interference (EMI).

Condition	<2kva	2-5kva	>5kva
Unshielded power lines or electrical equipment in proximity to open or non-metal pathways	6 inches	12 inches	24 inches
Unshielded power lines or electrical equipment in proximity to grounded metal conduit pathway	3 inches	6 inches	12 inches
Power lines enclosed in a grounded metal conduit (or equivalent shielding (in proximity to grounded metal conduit pathway)	2 inches	6 inches	6 inches
Transformers and Electric Motors	36 inches	36 inches	47 inches
Fluorescent lighting	12 inches	12 inches	12 inches

1. These guidelines apply to properly earth-bonded tray containing communications circuits in parallel with power circuits for a distance of 45 feet or more.
2. Communications circuits, contained in properly-bonded, ventilated trough tray, shall not be placed in the same cable tray as power circuits.

F. All cables shall originate and terminate at active or passive devices. Cables shall not be spliced. Where several devices are in close proximity, use approved housing to housing connectors and adapters.

G. All cables terminated in a connection plate mounted in an enclosure shall be dressed to allow cables to be removed from the enclosure and shall be of sufficient cable length to allow for service or re-termination. The plate shall either set on the floor or freely swing clear.

H. All cables installed in vertical tray or chases shall be supported by means of appropriately-sized vertical cable supports on every third floor. Do not use nylon cable ties.

I. Cable Installation in Conduit and Duct Banks

1. Through the entire length of all underground conduits, pull mandrel that is one size smaller than the conduit.

2. When pulling cable, use pulling lubrication.
3. During long or difficult runs, use a dynamometer to measure pulling tension. Place the dynamometer between the cable puller and the pull line to monitor pulling tension. Do not exceed the manufacturer's maximum pulling tension.
4. Apply pulling grips suitable for use with copper cables to the ends of the cable. Consult the cable manufacturer to determine the appropriate pulling grip and method of attachment. Use breakaway or fuse links at the pulling grip, and ensure that the correct "fuse pin" is installed in the fuse link.
5. To protect the cable ends until they are terminated, use cable caps (heat-shrinking type) to seal the ends of the cable.
6. Use cable blocks to facilitate the bending of cable. For bends between 5° and 45°, use a 45° cable block. For bends between 45° and 90°, use a 90° cable block.
7. The bend radius for all cables shall conform to manufacturer's specifications.

3.03 PATCH PANELS

A. Install patch panels in the equipment racks identified on the Drawings. Place patch panels as close as is practical to the locations depicted on the Drawings.

B. Install patch panels square and plumb, and fasten them to the mounting rails in four places using manufacturer-supplied screws, with at least one fastener at each corner.

C. Install horizontal cable support bars at the rear of all patch panels as indicated on the manufacturer's instructions.

D. Attach all accessories supplied with the panels per the manufacturer's instructions.

E. Restore all covers, panels, label holders, and accessories removed during the installation of panels to their original places and states.

F. On the front and rear of each patch panel, place a machine-generated, self-adhesive white label bearing the panel's identifier, as listed in the submittals, in black ½-inch block letters.

3.04 HORIZONTAL UTP

A. Install horizontal cable in a continuous length from the point of origin to the point of termination. Group all cables and bundle them in the overhead pathways in a neat and workmanlike manner.

B. The Contractor shall terminate and test all cables.

C. The Contractor shall not exceed the manufacturer's maximum pulling tension.

D. Splices shall not be allowed.

E. The Contractor shall make sure that all of the materials being installed on this project are of the proper rating (Plenum or Riser) required for the pathways and spaces by local, state, and federal codes.

F. No horizontal cables, including any required service loops, shall be more than 90 meters or 295 feet long. Prior to installation, the Contractor shall identify any area that cannot be reached within these constraints and shall report them to the Engineer. Do not install any data cable outside of these parameters without written approval from the Engineer.

G. Install cable paths perpendicular or parallel to the ceiling structure, unless otherwise shown on the Drawings.

H. Do not expose cable to water, paint overspray, paint removal products, or water-based pulling lubricants, as these substances can negatively impact the performance of the cable.

3.05 FACEPLATES AND JACKS

A. Faceplates

1. Provide faceplates in the configurations and quantities indicated on the Contract Drawings.
2. Fit faceplates to associated device boxes using appropriate adapters.
3. Install all faceplates square and plumb.
4. Within each faceplate, orient all UTP jacks with the locking tab at the bottom.

B. Terminations

1. Do not connect more than six cables in a 1-gang faceplate.
2. For 4-pair UTP cables, terminate all pairs to a single jack. Do not split pairs between jacks.
3. At the jack, remove the minimum amount of outer jacket.
4. Maintain the inherent Twists Per Inch (TPI) of UTP cable to within ½ inch of the termination.
5. Where provided, fit dust caps to all jacks.

3.06 FACTORY-TERMINATED BALANCED TWISTED PAIR CABLE ASSEMBLIES

A. All cable assemblies will be constructed and tested at the manufacturer's facilities.

B. Install cable assemblies in a continuous length from the point of origin to the point of termination. Group all cables and bundle them in the overhead pathways in a neat and workmanlike manner.

C. The Contractor shall terminate and test all cable assemblies.

D. The Contractor shall not exceed the manufacturer's maximum pulling tension.

E. Splices shall not be allowed.

F. The Contractor shall make sure that all of the materials being installed on this project are of the proper rating (Plenum or Riser) required for the pathways and spaces by local, state, and federal codes.

G. No UTP cable assembly, including any required service loops, shall be more than 90 meters or 295 feet long. Prior to installation, the Contractor shall identify any area that cannot be reached within these constraints and shall report them to the Engineer.

H. Do not install any data cable outside of these parameters without written approval from the Engineer.

I. Install cable paths perpendicular or parallel to the ceiling structure, unless otherwise shown on the Drawings.

J. Do not expose cable to water, paint overspray, paint removal products, or water-based pulling lubricants, as these substances can negatively impact the performance of the cable.

3.07 BALANCED TWISTED PAIR CORDAGE

A. Install equipment and station cords as directed by the Owner.

B. Route equipment cords in appropriate cable management accessories and maintain all required bend radius limits as specified by industry standards.

C. In racks and cabinets, separately route equipment cords along the longitudinal axis of the rack or cabinet so that no cord traverses the vertical centerline of the cabinet or rack except in an enclosed horizontal cable management panel.

D. Use equipment cords of sufficient length to allow each end of the cord to terminate at the appropriate interface without excessive strain or violation of the minimum bend radius for the selected medium.

3.08 CABLE BUNDLING MATERIALS

A. Use cable bundling and securing materials as required to ensure that cable runs are securely held in place both vertically and horizontally.

B. Do not tighten bundling materials or securing devices so as to cause deformation of the inherent cable geometry or construction.

C. Do not use cable ties or hook and latch tape to secure cable runs to other building systems (such as electrical conduit, EMT, sprinkler pipes, ceiling suspension members, etc.).

D. In areas considered environment air-handling spaces, only use appropriately-listed materials.

3.09 SYSTEM ADMINISTRATION

A. Uniquely identify all components of the installed system by location, function, unit, and sub-unit.

B. Identify each location with a unique alphanumeric identifier.

C. Assign a unique alphanumeric identifier for each equipment enclosure in the building.

D. Identify each adapter module in each distribution or interconnect enclosure with an alphanumeric identifier.

E. Identify all conduits, trays, and pathways with a unique alphanumeric identifier.

F. Identify optical fiber cables by a textual label that indicates its type, strand count, point of origin, and termination.

G. Supply a Cable Identification Matrix

H. Supply all records in compliance with ANSI/TIA-606.

I. Provide a database that is Open DataBase Connectivity (ODBC) compliant, for administration of the Structured Cabling System described in this Section.

3.10 IDENTIFICATION

A. Before installing or terminating cable, confirm all specific labeling requirements with the Owner or the Owner’s Engineer.

B. Cables

1. Mark each backbone cable at each endpoint and at all intermediate pull and access points, and junction boxes with labels that indicate the origination and destination

identifiers, the sheath identifier, and the strand or pair range.

2. Mark each horizontal cable on the sheath at each end with the TR, patch panel, and panel port to which the cable is wired. Mark block-terminated cables with a V in place of the panel ID.

C. Faceplates, Patch Panels, and Wiring Blocks

1. Mark each FDE with an adhesive label that indicates the range of circuits installed in it. Label each port with the origination and destination grid identifier and the individual strand ID.
2. Label patch panels alphabetically, beginning at the top. Individual ports shall come from the factory labeled with a number designation.
3. For each cable that a faceplate houses, label the faceplate to indicate the TR, patch panel, and panel port to which the cable is wired. Label block-terminated cables with the Telecommunication Room and "V" for the cable number.
4. Label each wiring block numerically, beginning at the top left of the termination field. Within each block, identify the individual rows alphabetically, beginning at the top left and proceeding sequentially down and to the right. Label each row with the corresponding cable identifier, and label each pair or circuit of each cable.
5. Fit all cables with self-laminating labels, bearing the appropriate cable identifier, that surround the outermost jacket. Place the labels within 75 mm (3 inches) of each end of the sheath.
6. Fit all equipment enclosures with a self-adhesive label, bearing the enclosure's respective identifier, affixed to the top center of the front and rear doors.
7. Fit each Fiber Distribution Enclosure with a self-adhesive label, affixed, bearing the enclosure's respective identifier in block characters, at the top center of the front and rear face.
8. Fit each adapter in each enclosure with a label, bearing the identifier, affixed directly adjacent to the adapter's shortest side. Rotate characters to keep their orientation left to right, top to bottom.

D. Conduits and Pathways

1. Label conduits and pathways within 0.5 m (18 inches) of each end, where exposed and accessible.
2. It is recommended that the Contractor provide additional labeling every 3 m (10 feet) of exposed length.

E. Network Equipment

1. Fit each network equipment unit with a label, in accessible areas at the front and rear, bearing the appropriate identifier, MAC address, and date of installation.
2. These labels shall not interfere with the operation of or interface to the unit, nor shall they obscure manufacturer's labels.

3.11 FIELD QUALITY CONTROL

A. General Testing

1. Refer to Section 27 08 00 – Commissioning of Communications for complete testing specifications.

B. Manufacturer's Field Service

1. At the start of the installation, periodically as the Work progresses, and after completion, furnish the services of the manufacturer's technical representative at the job site as needed to advise on every phase of the Work.
2. At minimum, furnish full-time attendance during the first three work days, and at least

once every week thereafter.

3. Furnish technical assistance to the Installer as required.

END OF SECTION