



SPECIFICATIONS

FOR

BID #21-08

ROSEWOOD ARTS CENTER RENOVATION

Bid Opening Date: June 10, 2021

VOLUME I



May 12, 2021

INVITATION TO BID - SPECIFICATION NO. 21-08

The City of Kettering intends to purchase the following and invites you to submit a sealed bid for:

ROSEWOOD ARTS CENTER RENOVATION

A **MANDATORY** Pre-Bid meeting is scheduled for **May 20, 2021 at 1:00pm at: Rosewood Arts Center**, located at 2655 Olson Drive, Kettering, Ohio. **Mandatory COVID19 Restrictions will apply.**

BIDS SHALL MEET OR EXCEED THE CITY OF KETTERING'S SPECIFICATIONS ATTACHED

Sealed bids will be received by the City of Kettering, Ohio, **on or before June 10, 2021 at 1:30pm** in the Finance Department office of the Purchasing Manager, Kettering Government Center, located at 3600 Shroyer Road. Bids received before the deadline will be publicly opened and read in the designated conference room at 2:00 p.m. Bids received after the deadline will not be considered.

Bidders should take caution if U.S. Mail is used for submission of bids. Mailing should be made in sufficient time for bids to arrive in the Finance Department prior to the deadline. **No email, verbal or fax bids will be accepted.**

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**CITY OF KETTERING
BID #21-08
ROSEWOOD ARTS CENTER RENOVATION**

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TECHNICAL SPECIFICATIONS

Refer to Table of Contents preceding Technical Specifications Sections

DRAWINGS – 2 sets - Bound Separately

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CITY OF KETTERING, OHIO
PROPOSAL
ROSEWOOD ARTS CENTER RENOVATION
BID SPECIFICATION NO. 21-08

TO THE CITY OF KETTERING, OHIO: **Due Date: June 10, 2021 at 1:30pm**

BIDDER: _____

The undersigned bidder, having full knowledge of the requirements of the City of Kettering for the below listed items and the contract documents (which includes the Invitation to Bid - Specification No. 21-08 and all attachments, Addenda, if any, this proposal, Contract,) agrees to sell and deliver to the City of Kettering the below listed item(s), complete in every respect and in strict accordance with the contract documents, at the price and in the time period specified below.

Please submit **1 copy** of this proposal and all required forms and mark the outside of the bid envelope – Bid #21-08 Rosewood Arts Center Renovation, along with the bidder's name and address.

Please note: Bidders can bid on either the Exterior or Interior Phase or both

BASE BID – EXTERIOR PHASE

\$

Alternates:

- | | |
|-----------------------------------------|-------------------------------------|
| Alternate 1: Buff brick veneer cleaning | Add/Deduct \$ _____
(circle one) |
| Alternate 2: Operable vent windows | Add/Deduct \$ _____
(circle one) |
| Alternate 3: 30 year TPO roof warranty | Add/Deduct \$ _____
(circle one) |

Unit Prices- Exterior Phase:

- | | | |
|-------------------------------------------------------|----------|---------------|
| Unit Price 1: Existing Roof Insulation Replacement | \$ _____ | per SF |
| Unit Price 2: Replacement of existing metal roof deck | \$ _____ | per SF |
| Unit Price 3: Brick veneer removal and replacement | \$ _____ | per 12 bricks |
| Unit Price 4: Mortar repair and pointing | \$ _____ | per 20 LF |
| Unit Price 5: Sealant replacement | \$ _____ | per 20 LF |
| Unit Price 6: Installation of weeps | \$ _____ | per 20 LF |
| Unit Price 7: Operable Doors in New Storefront | \$ _____ | per EA |

BASE BID – INTERIOR PHASE 1

\$

Unit Prices- Interior Phase 1:

- | | | |
|-------------------------------------------------------------------------|----------|--------|
| Unit Price 1: Install Gallery Wall Treatment | \$ _____ | per LF |
| Unit Price 2: Remove Existing Chalkboard/Tackboard and Refinish Wall | \$ _____ | per EA |
| Unit Price 3: Install Tackable Wall Finish Panels to Existing Wall Area | \$ _____ | per LF |

OVERHEAD AND PROFIT % ON CHANGE ORDERS - per General Conditions Section 7.1.5:

General Contractor Fee on Change Orders: O/H % _____ Profit % _____

Earliest Start Date: August 9, 2021

OF CALENDAR DAYS FOR COMPLETION: _____

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**CITY OF KETTERING, OHIO
 BID NO. 21-08 ROSEWOOD ART CENTER RENOVATION**

 BIDDER (Company)

 BY (Signature)

 STREET ADDRESS

 NAME (Please Print)

 CITY, STATE, ZIP CODE

 TITLE

 TELEPHONE/FAX

 DATE

The bidder acknowledges, by signature above, receipt of addendum Nos. _____ through _____.

Contact Person: Please provide the following information for the individual you would like us to contact regarding contract award:

Name	Title/Position	Phone/Fax	Email
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Please provide a list of references for projects with similar scope and content that your company has completed.

COMPANY	CONTACT	ADDRESS	TELEPHONE/FAX NUMBER
---------	---------	---------	----------------------

COMPANY	CONTACT	ADDRESS	TELEPHONE/FAX NUMBER
---------	---------	---------	----------------------

COMPANY	CONTACT	ADDRESS	TELEPHONE/FAX NUMBER
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COMPANY	CONTACT	ADDRESS	TELEPHONE/FAX NUMBER
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COMPANY	CONTACT	ADDRESS	TELEPHONE/FAX NUMBER
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BID BOND

FORM "A"

We, the undersigned bidder and surety, are held and firmly bound unto the City of Kettering, Ohio ("City") in the penal sum of FIVE PERCENT (5%) OF THE TOTAL BID AMOUNT, INCLUDING ALL ADD ALTERNATES, submitted by the undersigned bidder to the city of Kettering for the payment of which sum in lawful money of the United States, well and truly to be made, we hereby, jointly and severally, bind ourselves, our heirs, executors, administrators, successors and assigns firmly by these presents.

The condition of this obligation is such that if the undersigned bidder is awarded the contract, and if the undersigned bidder does, within fifteen (15) days after such award is made, enter into a contract and files the performance bond with the City using the prescribed forms, in accordance with the bid specifications, then this obligation shall be null and void; otherwise it shall remain in full force and effect.

In the event suit is brought upon this bond by the City and judgment is recovered, the bidder and/or the surety shall pay all costs incurred by the City in such suit including, without limitation, reasonable attorney's fees.

Signed and sealed this _____ day of _____, 20____.

(BIDDER)
By: _____

(SURETY)
By: _____

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IRREVOCABLE LETTER OF CREDIT

Applicant/Bidder:

Project:

Bid No. ____ - _____

Beneficiary:

City of Kettering, Ohio (the "City")
(an Ohio Municipal Corporation)
3600 Shroyer Road
Kettering, OH 45429
Amount of Letter of Credit: \$ _____

Date of Issuance: _____, 20____
Letter of Credit No. _____
Initial Expiration Date: _____, 20____

TO: The City of Kettering, Ohio, Attention: Finance Director

We hereby establish our Irrevocable Letter of Credit in your favor, at the request of the Applicant/Bidder identified above, and to serve as a bid guarantee for the City of Kettering project identified above. We authorize you to draw on us at the location set forth below, an aggregate amount of FIVE PERCENT (5%) OF THE TOTAL BID AMOUNT, INCLUDING ALL ADD ALTERNATES (_____ DOLLARS and _____ CENTS (\$ _____)), in U.S. Dollars, available by your draft at sight if, in your sole judgment, (1) the Applicant/Bidder was awarded the project and (2) within fifteen (15) days after notice of the award was given, the Applicant/Bidder failed to satisfactorily enter into a written contract with the City of Kettering and/or to post a performance bond as required by the bid specification for the project identified above.

Any drafts so drawn must be marked drawn under this Letter of Credit and accompanied by a written statement signed by the City Manager of the City of Kettering, or the City Manger's designee, as follows:

"I certify that I am either the City Manager of the City of Kettering, or the City Manger's appointed designee. I also certify that there has been a failure by the Applicant/Bidder to enter into a written contract and/or post a performance bond as required by letter of credit number (fill in number) _____."

This Letter of Credit shall be in full force and effect for a period beginning on the date it is received by the City of Kettering and extending for ninety (90) days after the deadline for submission of bids for the project identified above. If any expiration date falls on a Saturday, Sunday, or any day which we are not open for business, this Letter of Credit shall expire at the close of the next business day.

We engage with you that any drafts drawn under and in compliance with the terms of this Letter of Credit will be duly honored if presented during business hours at our office located in the state of Ohio at the street address of: _____

_____ ,
on or before the Initial Expiration Date, or any automatically extended date, as set forth above.

Very Truly Yours,

By:

Print or type name of bank

Signature of officer signing for bank

Print or type name and title of officer
who signs for bank

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PERFORMANCE BOND

KNOW ALL MEN BY THESE PRESENTS, that we, the undersigned _____ as principal and _____ as sureties, are hereby held firmly bound unto the City of Kettering as obligee in the penal sum of the dollar amount of the bid submitted by the principal to the obligee on _____ to undertake the project known as _____. The penal sum referred to herein shall be the dollar amount of the principal's bid to the obligee, incorporating any additive or deductive alternate proposals made by the principal on the date referred to above to the obligee, which are accepted by the obligee. In no case shall the penal sum exceed the amount of _____ dollars. (If the foregoing blank is not filled in, the penal sum will be the full amount of the principal's bid, including alternates. For the payment of the penal sum well and truly to be made, we hereby jointly and severally bind ourselves, our heirs, executors, administrators, successors, and assigns.

Signed this _____ day of _____, 20 ____ .

THE CONDITION OF THE ABOVE OBLIGATION IS SUCH, that whereas the above named principal has submitted a bid for _____.

Now, therefore, if the obligee accepts the bid of the principal and the principal, within fifteen days after the awarding of the contract, enters into a proper contract in accordance with the bid, plans, details, specifications, and bills of materials, which said contract is made a part of this bond the same as though set forth herein;

Now also if the said _____ shall well and faithfully do and perform the things agreed by the City to be done and performed according to the terms of said contract; and shall pay all lawful claims of subcontractors, materialmen, and laborers, for labor performed and materials furnished in the carrying forward, performing, or completing of said contract; we agreeing and assenting that this undertaking shall be for the benefit of any materialman or laborer having a just claim, as well as for the obligee herein and continuing until released by the City; then this obligation shall be void; otherwise the same shall remain in full force and effect; it being expressly understood and agreed that the liability of the surety for any and all claims hereunder shall in no event exceed the penal amount of this obligation as herein stated.

The said surety hereby stipulates and agrees that no modifications, omissions, or additions, in or to the terms of the said contract or in or to the plans or specifications therefore shall be in any wise affect the obligations of said surety on its bonds.

Signed, Sealed and Acknowledged in the presence of us:

_____ By _____ (Principal)

_____ (Surety)

_____ By _____

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IRREVOCABLE LETTER OF CREDIT

Applicant/Bidder:

Project:

Bid No. ____ - _____

Beneficiary:

City of Kettering, Ohio (the "City")
(an Ohio Municipal Corporation)
3600 Shroyer Road
Kettering, OH 45429

Date of Issuance: _____, 20____

Letter of Credit No. _____

Initial Expiration Date: _____

_____, 20____

Amount of Letter of Credit: \$ _____

TO: The City of Kettering, Ohio, Attention: Finance Director

We hereby establish our Irrevocable Letter of Credit in your favor, at the request of the Applicant/Bidder identified above, and to serve as a performance guarantee for the City of Kettering project identified above. We authorize you to draw on us at the location set forth below, an aggregate amount of

_____ DOLLARS and
_____ CENTS (\$ _____), in

U.S. Dollars, available by your draft at sight if, in your sole judgment, there has been a failure by Applicant/Bidder to satisfactorily perform or complete performance of the project identified above in accordance with the contract or articles of agreement for the project.

Any drafts so drawn must be marked drawn under this Letter of Credit and accompanied by a written statement signed by the City Manager of the City of Kettering, or the City Manger's designee, as follows:

"I certify that I am either the City Manager of the City of Kettering, or the City Manger's appointed designee. I also certify that there has been a failure by the Applicant/Bidder to perform or complete the performance required by the letter of credit number (fill in number) _____."

It is a condition of this Letter of Credit that it shall be deemed automatically extended without amendment for successive sixty (60) day periods from its present or any future expiration date unless no less than twenty (20) and no more than forty (40) days before any such expiration date we notify the City of Kettering Finance Director at your address listed above, in writing by certified mail, that we may elect not to consider this Letter of Credit renewed for any such additional period. If any expiration date falls on a Saturday, Sunday, or any day which we are not open for business, this Letter of Credit shall expire at the close of the next business day.

We engage with you that any drafts drawn under and in compliance with the terms of this Letter of Credit will be duly honored if presented during business hours at our office located at the street address of:

on or before the Initial Expiration Date, or any automatically extended date, as set forth above.

Very Truly Yours,

By:

Print or type name of bank

Signature of officer signing for bank

Print or type name and title of officer who signs for bank

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**ARTICLES OF AGREEMENT
BETWEEN OWNER AND CONTRACTOR**

This agreement is made as of the _____ day of _____, 20____,
between the City of Kettering, an Ohio municipal corporation (the Owner), and
_____, a duly organized and existing Ohio corporation,
partnership, sole proprietorship (circle the correct description) (the Contractor),

WITNESSETH:

WHEREAS, the Contractor submitted a bid or proposal to perform that work in Invitation To Bid – Specification No. _____; and

WHEREAS, the City has informed the Contractor that its bid is the lowest and best proposal;

NOW, THEREFORE, in consideration of the matters set forth in the above recital paragraphs and in further consideration of the mutual promises set forth below, the parties agree as follows:

**ARTICLE 1
THE CONTRACT DOCUMENTS**

The Contract Documents are defined in the Invitation To Bid for the Project. The Contract Documents, sometimes simply referred to as the Contract, represent the entire and integrated agreement between the parties and supersede prior negotiations, representations or agreements, whether written or oral.

**ARTICLE 2
THE WORK OF THIS CONTRACT**

The Contractor shall execute the Project and Work described in the Contract Documents, except to the extent specifically indicated in the Contract Documents to be the responsibility of others.

**ARTICLE 3
DATE OF COMMENCEMENT AND COMPLETION**

The Contractor shall complete all the Work within _____ days from the commencement date, subject to adjustments of this Contract Time as provided in the Contract Documents.

**ARTICLE 4
CONTRACT SUM**

The amount of money to be paid by the Owner to the Contractor for performance of the Work shall be the Contract Sum of \$_____, subject to additions and deletions as provided in the Contract Documents.

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ARTICLE 5
PAYMENT OF CONTRACT SUM

The Owner shall make payment or payments of the Contract Sum as follows: On the first Friday after the tenth of each calendar month, the Owner will issue checks as progress payment on the basis of timely filed applications by the Contractor for payment and on the basis of the Owner's actions under Sections 9.4 or 9.5 of the General Conditions.

IN WITNESS WHEREOF, these Articles of Agreement have been signed by the parties as of the day and year set forth on the first page, to be binding upon and to inure to the benefit of the parties and their respective heirs, personal representatives, successors, and such assigns as may be permitted under the Contract Documents. **At least two copies of this Agreement are to be signed by the parties, and each signed copy shall be deemed to constitute an original.**

CITY OF KETTERING, OWNER

BY: _____
Mark W. Schwieterman, City Manager

Print or type name of Contractor

BY: _____
Signature of Corporate President,
General Partner or Sole Proprietor

Print or type name of President, Partner or
Proprietor who signed above

Address and telephone number of
Contractor

If the Contractor is a partnership, set forth the microfiche number at which a certificate of partnership has been recorded in the office of the Recorder of Montgomery County, Ohio:

APPROVED AS TO FORM:

CERTIFICATION OF FUNDS:

Theodore A. Hamer III, Law Director

Nancy H. Gregory, Finance Director

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DISCLOSURE OF PERSONAL PROPERTY TAXES

STATE OF OHIO)
) SS:
COUNTY OF MONTGOMERY)

The undersigned being first duly cautioned and sworn says that he is the _____
_____ of _____

(Title)

(Company)

who made a bid for an improvement project or for the purchase of services and supplies for the City of Kettering, Ohio, involving the competitive bid process;

That Affiant says that he is familiar with Section 5719.042 of the Ohio Revised Code rewritten below and that he submits to the City of Kettering Finance Director as the Taxing District Fiscal Officer this statement affirmed under oath that as the person with whom the municipal contract is made was not charged at the time the bid was submitted with any delinquent personal property taxes on the general tax list of personal property of any county in which the taxing district known as the City of Kettering has territory or that such person was charged with delinquent personal property taxes on any such tax list;

(Strike out if not applicable.) This statement sets forth in full, the amount of such due and unpaid delinquent taxes and any dues and unpaid penalties and interest thereon as specified by Section 5719.042 which is made a part of this Affidavit;

The Affiant says that is this statement indicates that the taxpayer was charged with any such taxes, a copy of the statement; with the permission of the taxpayer, which is hereby given, shall be transmitted by the Finance Director of the City of Kettering to the County Treasurer within thirty days of the date this statement is submitted.

Affiant further says that a copy of the statement shall also be incorporated into the contract between the City of Kettering and agrees that no payment shall be made with respect to any contract to which Section 5719.042 Revised Code applies unless such statement has been so incorporated as a part thereof.

Section 5719.042. After the award by a taxing district of any contract let by competitive bid and prior to the time the contract is entered into, the person making a bid shall submit to the District's fiscal officer a statement affirmed under oath that the person with whom the contract is to be made was not charged at the time the bid was submitted with any delinquent personal property taxes on the general tax list of personal property of any county in which the taxing district has territory or that such person was charged with delinquent personal property taxes on any such tax list, in which case the statement shall also set forth the amount of such due and unpaid delinquent taxes and any dues and unpaid penalties and interest thereon. If the statement indicates that the taxpayer was charged with any such taxes, a copy of the statement shall be transmitted by the fiscal officer to the County Treasurer within thirty days of the date it is submitted.

A copy of the statement shall also be incorporated into the contract, and no payment shall be made with respect to any contract to which this section applies unless such statement has been so incorporated as a part thereof.

Signed

Sworn to and subscribed before me a Notary Public by _____ this _____ day of _____, 20____.

NOTARY PUBLIC

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INSTRUCTIONS TO BIDDERS

1. DEFINITIONS

For the purposes of the Invitation To Bid and the Contract, the following terms, phrases, words, and their derivations shall have the meanings as set forth below. When not inconsistent with the context, words in the present tense include the future tense, words in the plural number include the singular number, and words in the singular number include the plural number. The words "shall" and "will" are mandatory and "may" is permissive. Words not defined but which have well-known technical or construction industry meanings are used in accordance with such recognized meanings; words without well-known technical or construction industry meanings shall be given their common and ordinary meaning. Defined terms remain defined terms whether or not capitalized.

1. **Addenda** - The written or graphic instruments issued by the Owner prior to the execution of the Contract which modify or interpret the Bidding Documents by additions, deletions, clarifications, or corrections.
2. **Advertisement** – A notice, published in a newspaper, that bids for the Work are being accepted.
3. **Alternate Bid** (or Alternate) – An amount stated in the Bid to be added to or deducted from the amount of the Base Bid if the corresponding change in the Work, as described in the Bidding Documents, is accepted.
4. **Base Bid** - The amount stated in a Bid as the sum for which the Bidder offers to perform the Work in a particular trade or other category, which is described in the Contract Documents, excluding Alternate Bids.
5. **Bidder** - A person or entity who submits a proposal or bid to perform the work.
6. **Bidding Documents** - The Invitation To Bid.
7. **Bid** - A complete and properly signed proposal to do the Work for the sums stipulated therein, submitted in accordance with the Bidding Documents.
8. **Change Order** -- A written agreement entered into after the award of the Contract that alters or amends the Work.
9. **City** – The City of Kettering Ohio.
10. **Contract** - The Contract Documents. 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. A Modification is (1) a written amendment to the Contract signed by both parties, (2) a Change Order, or (3) a written order for a minor change in the Work issued by the Owner.

11. **Contract Documents** - The Articles of Agreement (hereinafter the "Agreement") together with the Invitation To Bid including, but not limited to, specifications, technical specifications, conditions, supplements, project drawings (even if published separately), plus any Addenda issued prior to execution of this Agreement, and the written bid or proposal submitted by the Contractor. The Contract Documents also include any bidding or proposal requirements (advertisement or invitation to bid or to submit a proposal and instructions to bidders or proposers), sample forms, the Contractor's bid or proposal and addenda relating to bidding requirements.
12. **Contract Sum** – The amount to be paid by the owner for the Work as set out in the Article of Agreement.
13. **Contractor** – An entity or person, which is party to the Contract for the performance of Work on the Project in cooperation with Separate Contractors and Persons, and in accordance with the Contract Documents.
14. **Deadline** - The time and date designated for receipt of bids.
15. **Invitation To Bid** - The document labeled "Invitation To Bid," and all attachments including, but not limited to, general specifications, technical specifications, conditions, supplements, project drawings (even if published separately), plus anything incorporated by reference in the Invitation To Bid and any subsequently issued addenda
16. **Owner** – The City of Kettering, Ohio.
17. **Owner's Architect** – Owner's Architect is identified in the technical specification.
18. **Product Data** - 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.
19. **Project** - A public improvement, of which the Work performed under the Contract Documents may be the whole or a part.
20. **Project Drawings** (Drawings) - The Drawings are the graphic and pictorial portions of the Contract Documents, wherever located and whenever issued, showing the design, location and dimensions of the Work, generally including plans, elevations, sections, details, schedules and diagrams.
21. **Samples** - Physical examples which illustrate materials, equipment or workmanship and establish standards by which the Work will be judged.
22. **Shop Drawings** - 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.
23. **Specification** - The instructions and requirements prepared by the Owner which complement the Plans and describe the manner of performing the work, the quantities, qualities and types of materials to be furnished, equipment, construction systems, standards and workmanship for the Work, and performance of related services.
24. **Sub-bidder** - A person or entity who submits a bid to a Bidder for materials, equipment or labor for a portion of the Work.

25. **Sub-contractor/subcontractor** - A person or entity who undertakes to perform any part of the Work on the Project under a contract with a Contractor or with any person other than the City, including all such persons in any tier.
26. **Supplementary Instructions** - Amendments or additions to instructions, issued as a separate document, which contain instructions and/or describe conditions unique to a particular Project.
27. **Unit Price** - An amount stated in the Bid as a price per unit of measurement for materials, equipment or services or a portion of the Work as described in the Bidding Documents.
28. **Work** - The labor, materials, equipment, and services, individually or collectively which are required by the Contract Documents, to be performed or provided by the Contractor for the Project. The Work may constitute the whole or a part of the Project.

2. **BIDDER'S REPRESENTATIONS**

2.1 The Bidder by making a Bid represents that:

- 2.1.1 The Bidder has read and understands the Bidding Documents and the Bid is made in accordance therewith. Any deviation from or conflicts with the Bidding Documents are to be specified and explained in the Bid as such deviations or conflicts.
- 2.1.2 The Bidder has read and understands the Bidding Documents or contract documents, to the extent that such documentation relates to the Work for which the Bid is submitted, for other portions of the Project, if any, being bid concurrently or presently under construction.
- 2.1.3 The Bidder has visited the site, become familiar with local conditions under which the Work is to be performed and has correlated the Bidder's personal observations with the requirements of the proposed Contract Documents.
- 2.1.4 The Bid is based upon the materials, equipment and systems required by the Bidding Documents without exception.

3. **BIDDING DOCUMENTS**

3.1 **COPIES**

- 3.1.1 Bidders may obtain complete sets of the Bidding Documents from the issuing office designated in the Advertisement or Invitation to Bid in the number and for the deposit sum, if any, stated therein.
- 3.1.2 Bidders shall use complete sets of Bidding Documents in preparing Bids; the Owner has no responsibility for errors or misinterpretations resulting from the use of incomplete sets of Bidding Documents.
- 3.1.3 In making copies of the Bidding Documents available on the above terms, the Owner does so only for the purpose of obtaining Bids on the Work and does not confer a license or grant permission for any other use of the Bidding Documents.

3.2 **INTERPRETATION OR CORRECTION OF BIDDING DOCUMENTS**

- 3.2.1 The Bidder shall carefully study and compare the Bidding Documents with each other, and with other work being bid concurrently or presently under construction to the extent that it relates to the Work for which the Bid is submitted, shall examine the site and local conditions, and shall at once report to the Owner errors, inconsistencies or ambiguities discovered.
- 3.2.2 Bidders and Sub-bidders requiring clarification or interpretation of the Bidding Documents shall make a written request at least seven (7) days prior to the date for receipt of Bids.
- 3.2.3 Interpretations, corrections and changes of the Bidding Documents will be made by Addendum. Changes of the Bidding Documents made in any other manner will not be binding, and Bidders shall not rely upon them.

3.3 **SUBSTITUTIONS**

- 3.3.1 The materials, products and equipment described in the Bidding Documents establish a standard of required function, dimension, appearance and quality to be met by any proposed substitution.
- 3.3.2 No substitution will be considered prior to receipt of bids unless a written request for approval has been received by the Owner's Architect at least ten (10) working days prior to the date for receipt of bids. Such requests shall include the name of the material or equipment for which it is to be substituted and a complete description of the proposed substitution including drawings, performance and test data, and other information necessary for an evaluation. A statement setting forth changes in other materials, equipment or other portions of the Work including changes in the work of other contracts that incorporation of the proposed substitution would require shall be included. The burden of proof of the merit of the proposed substitution is upon the Bidder. The Owner's decision of approval or disapproval of a proposed substitution shall be final.
- 3.3.3 If the Owner approves a proposed substitution prior to receipt of bids, that approval shall be set forth in an Addendum. Bidders may not rely upon approval made in any other manner.
- 3.3.4 No substitutions will be considered after the Contract award unless specifically provided in the Contract Documents.

3.4 **ADDENDA**

- 3.4.1 Addenda will be mailed or delivered to all who are known by the issuing office to have received a complete set of Bidding Documents.
- 3.4.2 Copies of Addenda will be made available for inspection wherever Bidding Documents are on file for that purpose.
- 3.4.3 No Addendum will be issued later than four (4) working days prior to the date for receipt of bids, except Addenda withdrawing the request for bids or postponing the date for receipt of bids.
- 3.4.4 Each Bidder shall ascertain prior to submitting a Bid that the Bidder has received all Addenda issued, and the Bidder shall acknowledge their receipt in the Bid.

4. **BIDDING PROCEDURES**

4.1 **FORM AND STYLE OF BIDS**

- 4.1.1 Bids shall be submitted on forms identical to the form included with the Bidding Documents.
- 4.1.2 All blanks on the bid form shall be filled in by typewriter or manually in ink.
- 4.1.3 Interlineations, alterations and erasures must be initialed by the signer of the Bid.
- 4.1.4 All requested Alternates shall be bid.
- 4.1.5 Each copy of the proposal shall be signed by the person or persons legally authorized to bind the Bidder to a contract. A Bid submitted by an agent shall have a current power of attorney attached certifying the agent's authority to bind the Bidder. A Bid by a partnership shall constitute an agreement by the Bidder to complete and record with the County Recorder a partnership certificate, listing the names and addresses of all partners and those partners whose signatures are required to bind the partnership, if the Bidder is awarded a Contract.

4.2 **BID SECURITY**

- 4.2.1 Bids shall be accompanied by bid security equal to or exceeding FIVE PERCENT (5%) OF THE TOTAL BID AMOUNT, INCLUDING ALL ADD ALTERNATES, to ensure that in the event the bid is accepted the bidder will enter into a contract with Owner and the performance thereof will be properly secured. The bid security shall be in the form of a bid bond in which case Form "A" shall be used, an irrevocable letter of credit, in which case Form "C" shall be used, or cash, in which case Form "E" shall be used.
- 4.2.2 If, within fifteen (15) days after notice of award was given, the bidder fails to (a) enter into the contract to perform the work contemplated by the proposal, (b) furnish satisfactory bid security using the required

forms, and (c) do all other acts required as conditions precedent to executing the contract, the bidder shall be liable to the City for the amount of the bid security which shall be forfeited to the City. In the event suit is brought by the City and judgment is recovered, the bidder and/or the surety shall pay all costs incurred by the City in such suit including, without limitation, reasonable attorney's fees.

- 4.2.3 The Owner will have the right to retain the bid security of Bidders to whom an award is being considered until either (a) the Contract has been executed and performance security has been furnished, or (b) the specified time has elapsed so that Bids may be withdrawn, or (c) all Bids have been rejected.

4.3 **SUBMISSION OF BIDS**

- 4.3.1 All copies of the Bid, the bid security, if any, and other documents required to be submitted with the Bid shall be enclosed in a sealed envelope. The envelope shall be addressed to the Owner or to such other person as the Owner may designate and shall be identified with the Project name, the Bid number, the Bidder's name and address and, if applicable, the designated portion of the Work for which the Bid is submitted.
- 4.3.2 Bids shall be deposited at the designated location prior to the deadline. Bids received after the deadline will be rejected.
- 4.3.3 The Bidder shall assume full responsibility for timely delivery at the location designated for receipt of Bids.
- 4.3.4 Oral, telephonic, facsimile, email, or telegraphic Bids are invalid and will not receive consideration.

4.4 **MODIFICATION OR WITHDRAWAL OF BID**

- 4.4.1 A Bid may not be modified, withdrawn or canceled by the Bidder during the stipulated time period following the deadline for the receipt of Bids, and each Bidder so agrees in submitting a Bid.
- 4.4.2 Prior to the deadline for receipt of Bids, a Bid submitted may be modified or withdrawn by giving notice to the City at the place designated for receipt of Bids. Such notice shall be in writing over the signature of the Bidder. A change shall be so worded as not to reveal the amount of the original Bid.
- 4.4.3 Withdrawn Bids may be resubmitted up to the deadline for the receipt of Bids provided that they are then fully in conformance with these Instructions to Bidders.
- 4.4.4 Bid security, if required, shall be in the required amount and shall be on the appropriate form included in the Invitation To Bid.

5. CONSIDERATION OF BIDS

5.1 OPENING OF BIDS

5.1.1 Bids will remain firm for sixty (60) calendar days after bid opening. The award of the Contract, if any award be made, will be made within sixty (60) calendar days after the opening of bids to the lowest and best bidder(s) whose bid complies with all the requirements prescribed, exclusive of the technicalities waived. Until the final award of the Contract, however, the right is reserved by the City to reject any and all bids and to waive informalities, irregularities, or defects in bids.

5.1.2 Unless stated otherwise in the Advertisement or Invitation to Bid, the properly identified Bids received on time will be opened publicly and a summary will be read aloud. An abstract of the Bids will be made available to Bidders within a reasonable time.

5.2 REJECTION OF BIDS

5.2.1 The Owner shall have the right to reject any or all Bids, reject a Bid not accompanied by required bid security or by other data required by the Bidding Documents, or reject a Bid which is in any way incomplete or irregular.

5.2.2 The Owner shall have the right to waive informalities or irregularities in a Bid.

5.3 ACCEPTANCE OF BID (AWARD)

5.3.1 It is the intent of the Owner to award a Contract to the lowest and best Bidder provided the Bid has been submitted in accordance with the requirements of the Bidding Documents and does not exceed the funds available. The Owner shall have the right to waive informalities or irregularities in a Bid received and to accept the Bid which, in the Owner's judgment, is in the Owner's own best interests.

5.3.2 The Owner shall have the right to accept Alternates in any order or combination, unless otherwise specifically provided in the Bidding Documents, and to determine the lowest and best Bidder on the basis of the sum of the Base Bid and Alternates accepted.

6. POST-BID INFORMATION

6.1 CONTRACTOR'S QUALIFICATION STATEMENT

Bidders to whom award of a Contract is under consideration shall submit to the Owner, upon request, a properly executed Owner's form entitled "Contractor's Qualification Statement," unless such a Statement has been previously required and submitted as a prerequisite to the issuance of Bidding Documents.

6.2 SUBMITTALS

- 6.2.1 The Bidder shall, as soon as practicable after notification of selection for the award of a Contract, furnish to the Owner, in writing:
 - 6.2.1.1 a designation of the Work to be performed with the Bidder's own forces;
 - 6.2.1.2 names of the manufacturers, products and the suppliers of principal items or systems of materials and equipment proposed for the Work; and
 - 6.2.1.3 names of persons or entities (including those who are to furnish materials or equipment fabricated to a special design) proposed for all portions of the Work.
 - 6.2.1.4 a detailed schedule of values, prepared in such a form as the Owner may require.
- 6.2.2 If requested by the Owner, the Bidder will be required to establish to the satisfaction of the Owner the reliability and responsibility of the persons or entities proposed to furnish and perform the Work described in the Bidding Documents.
- 6.2.3 Prior to the award of the Contract, the Owner will notify the Bidder in writing if the Owner, after due investigation, has objection to a person or entity proposed by the Bidder. If the Owner has objection to a proposed person or entity, the Bidder may, at the Bidder's option, (1) withdraw the Bid, or (2) submit an acceptable substitute person or entity. The Owner may accept the substitution or disqualify the Bidder. In the event of either withdrawal or disqualification, bid security will not be forfeited.
- 6.2.4 Persons and entities proposed by the Bidder and to whom the Owner has made no objection must be used on the Work for which they were proposed and shall not be changed except with the written consent of the Owner.
- 6.2.5 The fact that the Owner has not objected to such a person or entity shall not relieve the Bidder of responsibility for the selection of that person or entity or from liability to the Owner for that person's or entity's work being complete, correct, timely and in accordance with the Contract Documents.

7. PERFORMANCE AND PAYMENT SECURITY

7.1 REQUIREMENTS

- 7.1.1 Security in an amount equal to 100% of the total contract sum is required as a guarantee that the Bidder will completely perform according the terms of the Contract Documents. The security shall be in the form of a performance bond in which case Form "B" shall be used, an irrevocable letter of credit, in which case Form "D" shall be used, or cash, in which case Form "F" shall be used.

- 7.1.2 Bonding companies must be a surety company authorized to do business in the State of Ohio, and shall be subject to approval by the Owner on the basis of the financial strength of the bond company, the Owner requiring the sureties on its bonds be among the strong companies writing such bonds in Ohio.
- 7.1.3 For irrevocable letters of credit, the issuing bank is subject to approval by the City and must have an office located in Montgomery County, Ohio, or any of the counties which border Montgomery County, Ohio where the City can draw on the letter of credit.

7.2 TIME OF DELIVERY AND FORM OF SECURITY

- 7.2.1 The Bidder shall deliver the required security to the Owner not later than three (3) days before the date of execution of the Contract.
- 7.2.2 The security shall be in the amount of the contract sum.
- 7.2.3 The security shall be dated on or after the date of the Contract.
- 7.2.4 The Bidder shall require the attorney-in-fact who executes any performance and payment bonds on behalf of the surety to affix thereto a certified and current copy of the power of attorney.

8. FORM OF AGREEMENT BETWEEN OWNER AND CONTRACTOR

The Agreement for the Work will be written on the Owner's Articles of Agreement between Owner and Contractor where the basis of payment is a stipulated sum.

GENERAL CONDITIONS OF THE CONTRACT FOR CONSTRUCTION

1. GENERAL

1.1 EXECUTION, CORRELATION AND INTENT

- 1.1.1 The Articles of Agreement shall be signed by the Owner and Contractor, and this shall bind the parties to the Contract.
- 1.1.2 By signing the Agreement, the Contractor represents that the Contractor has visited the site, become familiar with local conditions under which the Work is to be performed and correlated personal observations with requirements of the Contract Documents.
- 1.1.3 The intent of the Contract Documents is to include all items 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. Performance by the Contractor shall be required not only as specified in the Contract Documents but also as reasonably inferable from them as being necessary or appropriate to produce the intended results.
- 1.1.4 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 CAPITALIZATION

Terms capitalized in these General Conditions include those which are (1) specifically defined, (2) the titles of numbered articles and identified references to Paragraphs, Subparagraphs and Clauses in the document or (3) the titles of other documents included as part of the Contract Documents.

1.3 INTERPRETATION

- 1.3.1 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.
- 1.3.2 Mention of any specific duty or liability of the Contractor in the Contract Documents shall not be construed as a limitation or restriction upon any general liability or duty imposed upon the Contractor by law or any other portion of the Contract Documents. No aspect of interpretation or application of the Contract Documents shall be affected by the fact that those documents may have been prepared by one party or the other.
- 1.3.3 Contractor is an independent contractor to City and is responsible for methods and means used in performing its Services under this Agreement and is not an employee, agent, or partner of City.

- 1.3.4 If any provision of this the Contract Documents or their application to any person or circumstance shall be held invalid or unenforceable to any extent by a court having jurisdiction over the parties, the remainder of this agreement and its application shall not be affected and instead shall be enforced to the extent permitted by Ohio law.
- 1.3.5 Delay or forbearance in the enforcement of any right under this Agreement shall not be deemed a waiver of, or estoppel against the exercise of, such right.

2. **OWNER**

2.1 **OWNER'S RIGHT TO STOP THE WORK**

If the Contractor fails to promptly and diligently correct Work which is not in accordance with the requirements of the Contract Documents or fails to carry out Work in accordance with the Contract Documents, the Owner may order 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.

2.2 **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 seven-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 after such seven-day period, 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 Owner's cost of correcting such deficiencies, including but not limited to the salary and fringe benefits paid to any employees of the Owner for such time as they were involved in such efforts or in supervision or administration thereof. If payments then or thereafter due the Contractor are not sufficient to cover such amounts, the Contractor shall pay the difference to the Owner.

3. **CONTRACTOR**

3.1 **REVIEW OF CONTRACT DOCUMENTS AND FIELD CONDITIONS BY CONTRACTOR**

3.1.1 Before beginning any construction activity, the Contractor shall carefully study and compare all parts of the Contract Documents with each other and with information furnished by the Owner. The Contractor shall at once report to the Owner, in writing, errors, inconsistencies or omissions discovered and shall be liable to the Owner for damage (including extra cost to the Owner and also delay) resulting from errors, inconsistencies or omissions in the Contract Documents which the Contractor should have recognized but which the Contractor failed to report, in writing, to the Owner. If the Contractor performs any construction activity which involves an error, inconsistency or omission in the Contract Documents the Contractor should have recognized, without such notice to the Owner, the Contractor shall assume responsibility for such performance and shall bear the costs for correction. Oral notice is no notice.

- 3.1.2 The Contractor shall take field measurements, perform site testing and verify field and site conditions and shall carefully compare such field measurements and conditions and other information known to the Contractor with all parts of the Contract Documents before commencing activities. Errors, inconsistencies or omissions discovered shall be reported to the Owner at once, in writing. The Contractor shall be liable to the Owner for damage (including extra cost to the Owner and delay) resulting from errors, inconsistencies or omissions which the Contractor should have discovered but which the Contractor failed to report, in writing, to the Owner. Throughout this entire Contract, oral notice is no notice.
- 3.1.3 The Contractor shall perform the Work in accordance with the Contract Documents and any shop drawings and approved in writing by the City.

3.2 **SUPERVISION AND CONSTRUCTION PROCEDURES**

- 3.2.1 The Contractor shall supervise and direct the Work, using the Contractor's best skill and attention. The fact that the Contractor may also be working on projects for other owners shall not excuse the Contractor from failing to give such skill and attention to the Work. The Contractor shall be solely responsible for and have control over construction means, methods, techniques, sequences and procedures for making and keeping the Work and surrounding area (and all equipment) safe for the Contractor and for all other persons and in compliance with applicable codes and state and federal safety requirements, and for coordinating all portions of the Work under the Contract, unless the Contract Documents give other specific instructions concerning these matters.
- 3.2.2 The Contractor shall be liable to the Owner for acts and omissions of the Contractor's employees, Subcontractors and their agents and employees, and other persons performing portions of the Work under a contract with the Contractor and for their work being complete, correct, timely and in accordance with the Contract Documents. The fact that the Contractor may have used due care in selecting such persons or organization, or the fact that the Owner may have failed to object to the use of such persons or organizations, will not relieve the Contractor of this liability.
- 3.2.3 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 Owner in the Owner's administration of the Contract, or by tests, inspections or approvals required or performed by persons other than the Contractor.

3.2.4 The Contractor shall be responsible for inspection of portions of Work already performed under this Contract to determine that such portions are in proper condition to receive subsequent Work. Errors, inconsistencies or omissions shall be reported to the Owner at once, in writing. The Contractor shall be liable to the Owner for damage (including extra cost to the Owner and delay) resulting from errors, inconsistencies or omissions which the Contractor should have discovered but which the Contractor failed to report, in writing, to the Owner.

3.3 **SUNDAY AND NIGHT WORK**

The Contractor is required to prosecute Work done under this contract during daylight hours. No Work will be permitted on Sundays or during the night season except as authorized or directed by the City.

3.4 **CHARACTER OF WORKERS**

3.4.1 The Contractor shall at all times employ or contract for sufficient labor and equipment for prosecuting the several classes of work to full completion in the manner and time required by these specifications.

3.4.2 All workers shall have sufficient skill and experience to perform properly the work assigned to them.

3.4.3 Workers engaged in special work or skilled work shall have sufficient experience in such work and in the operation of the equipment required to perform all work properly and satisfactorily.

3.4.4 Any person employed by the Contractor or by any subcontractor who, in the opinion of the Owner, does not perform his work in a proper and skillful manner or is intemperate or disorderly shall, at the written request of the Owner, be removed forthwith by the Contractor or subcontractor employing such person, and shall not be employed again in any portion of the work without the approval of the Owner.

3.4.5 Should the Contractor fail to remove such person or persons as required above, or fail to furnish suitable and sufficient personnel for the proper prosecution of the Work, the Owner may withhold payments which are or may become due, or may suspend the Work by written notice or both, until the Contractor complies with such orders.

3.5 **LABOR AND MATERIALS**

3.5.1 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.

3.5.2 The Contractor shall enforce strict discipline and good order among the Contractor's employees and other persons carrying out the Contract.

The Contractor shall not employ unfit persons or persons not skilled in tasks assigned to them nor contract for nor permit its Subcontractor to use such persons.

3.6 WARRANTY

The Contractor warrants to the Owner that (i) materials and equipment furnished under the Contract will be of good quality and new unless otherwise required or expressly stated to the contrary in the Contract Documents, (ii) that the Work will be free from defects not inherent in the quality required or permitted, and (iii) that the Work and the Contractor's methods and procedures will conform with the requirements of the Contract Documents. Work not conforming to these requirements, including substitutions not properly approved and authorized, may be considered by Owner, in Owner's sole discretion, to be defective. This warranty shall extend for one year after written acceptance by Owner of all the Work, except that the Contractor's liability for any failure to comply with applicable codes or state or federal safety requirements shall continue as long as any such codes or requirements may be enforced against the Work or against the Owner with regard to the Work. Any failure of a matter referred to above will be sufficient to support a warranty claim. The Contractor shall promptly remedy all defects or failures which appear before the end of this year, at no cost to the Owner. If the Contractor fails to do so within seven (7) days after notification, the Owner may, as one possible remedy, correct the defect and charge all cost thereof to the Contractor and/or set-off such amount against any monies payable to the Contractor or performance security, including the time value (i.e. salary and fringe benefits) of Owner's own employees in doing so or administering this warranty recovery. In case of an emergency, the Owner may dispense with notice, correct the defect, and charge the Contractor in this manner.

3.7 TAXES

The Contractor shall pay sales, consumer, use and similar taxes for the Work, while the Owner shall reduce this obligation by furnishing tax exempt certificates to the extent allowed by law.

3.8 PERMITS, FEES, NOTICES AND APPLICABLE CODES

3.8.1 Unless otherwise expressly provided to the contrary in the Contract Documents, the Contractor shall secure and pay for the building permit and other permits and governmental fees, licenses and inspections necessary for proper execution and completion of the Work.

3.8.2 The Contractor shall comply with and give notices required by laws, ordinances, rules, regulations and lawful orders of public authorities bearing on performance of the Work.

- 3.8.3 It is the Contractor's responsibility to ascertain that the Contract Documents are in compliance with applicable laws, statutes, ordinances, building, fire and other codes, and rules and regulations. The fact that the Owner may be the City in which the work is to be performed shall not relieve the Contractor of this responsibility. The building permit personnel of the City shall be available to review the drawings and specifications and to advise the Contractor whether or not they comply. Before bidding for or setting a price on or beginning the Work, the Contractor shall read all specifications and review all plans for compliance with such matters and shall report any discrepancy to the Owner immediately. Where the requirements of the plans and specifications fail to comply with such applicable laws, statutes, etc., the Owner shall adjust the plans or specifications accordingly (unless waivers in writing governing the difference have been or are granted by the governing body or department).
- 3.8.4 If the Contractor performs, or permits to be done through its employees, subcontractors or agents, Work which is contrary to laws, statutes, ordinances, building codes, or rules or regulations, the Contractor shall have full liability for such Work and shall bear the attributable costs.
- 3.8.5 The Contractor shall also comply at its cost with all applicable laws and ordinances and rules governing the removal and eventual disposal of materials, debris, rubbish and trash. All debris, brush, dead trees, trash, rubbish and other matter found in or immediately adjacent to any structure required by the Contract to be demolished shall also be removed and disposed of by the Contractor in accordance with applicable laws, ordinances, rules, and elsewhere in the Contract at the expense of the Contractor.

3.9 **ALLOWANCES**

- 3.9.1 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 against whom or which the Contractor makes and supports reasonable objection.
- 3.9.2 Unless otherwise provided in the Contract Documents:
- 3.9.2.1 Materials and equipment under an allowance shall be selected promptly by the Owner to avoid delay in the Work.
- 3.9.2.2 Allowances shall cover the cost to the Contractor of materials and equipment delivered at the site and all required taxes, less applicable trade discounts.
- 3.9.2.3 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 and not in the allowances.

- 3.9.2.4 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 Paragraph 3.9.2.2 and (2) changes in Contractor's costs under Paragraph 3.9.2.3.

3.10 SUPERINTENDENT

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 be the Contractor's authorized and shall be named as such in a written notice delivered by the Contractor to the Owner. Communications given to the superintendent shall be as binding as if given to the Contractor. Communications shall be confirmed promptly by Contractor in writing.

3.11 CONTRACTOR'S CONSTRUCTION SCHEDULES

- 3.11.1 The Contractor, promptly after being awarded the Contract, shall prepare and submit for the Owner's information a Contractor's construction schedule for the Work. The schedule shall not exceed time limits set or referred to in the Contract Documents, shall be revised at appropriate intervals as required by the conditions of the Work and Project and to the extent permitted by the Contract Documents, 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.
- 3.11.2 The Contractor shall prepare, and keep current for the Owner's approval, a schedule of submittals which is coordinated with the Contractor's construction schedule and allows the Owner reasonable time to review and approve, disapprove or modify submittals.
- 3.11.3 The Contractor shall conform to the most recent schedules approved by Owner.

3.12 DOCUMENTS AND SAMPLES AT THE SITE

The Contractor shall maintain at the site for the Owner one record copy of the Drawings, Specifications, Addenda, Change Orders and other Modifications, in good order and marked currently to record changes and selections made during construction and, in addition, approved Shop Drawings, Product Data, Samples and similar required submittals. These shall be available to the Owner and shall be delivered to and become the property of the Owner upon completion of the Work or at such earlier time as the Contract may be terminated.

3.13 SHOP DRAWINGS, PRODUCT DATA AND SAMPLES

- 3.13.1 Shop Drawings, Product Data, Samples and similar submittals are not Contract Documents. The purpose of their submittal is to demonstrate (for those portions of the Work for which submittals are required) the way the Contractor proposes to conform to the information given and the design concept expressed in the Contract Documents.
- 3.13.2 The Contractor shall review, approve and submit to the Owner Shop Drawings, Product Data, Samples and similar submittals required by the Contract Documents 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. Submittals made by the Contractor which are not required by the Contract Documents may be returned without action.
- 3.13.3 The Contractor shall perform no portion of the Work requiring submittal and review of Shop Drawings, Product Data, Samples or similar submittals until the respective submittal has been approved by the Owner. Such Work shall be in accordance with Owner approved submittals.
- 3.13.4 By approving and submitting Shop Drawings, Product Data, Samples and similar submittals, the Contractor represents that the Contractor has determined and verified materials, site conditions and field measurements and field and site construction criteria related thereto, or will do so, and has checked and coordinated the information contained within such submittals with the requirements of the Work and of the Contract Documents.
- 3.13.5 The Contractor shall not be relieved of responsibility for deviations from requirements of the Contract Documents by the Owner's approval of Shop Drawings, Product Data, Samples or similar submittals unless the Contractor has specifically informed the Owner, in writing, at the time of submittal that such a deviation is being proposed in such submittals, has specifically identified the exact manner or aspect of Work which would have the deviation and described that deviation, and unless the Owner has given express written approval to the specific deviation. The Contractor shall not be relieved of responsibility for errors or omissions in Shop Drawings, Product Data, Samples or similar submittals by the Owner's approval thereof.
- 3.13.6 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 Owner on previous submittals.
- 3.13.7 Informational submittals upon which the Owner is not expected to take responsive action must be so identified, in writing, when submitted by the Contractor.

3.13.8 When professional certification of performance criteria of materials, systems or equipment is required by the Contract Documents, the Owner shall be entitled to rely upon the accuracy and completeness of such opinions calculations and certifications from professionals engaged by the Owner. The Contractor is responsible for such calculations, opinions and certifications being accurate and complete if from professionals engaged by the Contractor.

3.14 **USE OF SITE**

The Contractor shall confine operations at the site to areas permitted by law, ordinances, permits and the Contract Documents and shall not unreasonably encumber the site with materials or equipment.

3.15 **CUTTING AND PATCHING**

3.15.1 The Contractor shall be responsible for cutting, fitting or patching required to complete the Work or to make its parts fit together properly.

3.15.2 Neither the Contractor or any Subcontractor shall damage or endanger any portion of the Work (or fully or partially completed construction of the Owner or separate contractors) by cutting, patching, excavation or in any other manner. The Contractor shall not cut or otherwise alter any 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. Similarly, the Contractor shall not unreasonably withhold from the Owner or a separate contractor the Contractor's consent to cutting or otherwise altering the Work.

3.16 **CLEANING UP**

3.16.1 The Contractor shall keep the premises and surrounding area free from accumulation of waste materials or rubbish, except in dumpsters or such other containers as may be approved by the Owner in writing, with this clean-up to be performed each day. At completion of the Work, the Contractor shall immediately remove from and about the Project waste materials, rubbish, the Contractor's tools, construction equipment, machinery, dumpsters and other waste containers and surplus materials.

3.16.2 If the Contractor fails to clean up as provided in the Contract Documents, the Owner may do so without notice to the Contractor, and the direct and indirect cost thereof, including the time value (i.e. salary and fringe benefits) of Owner's employees who perform and administer such Work, shall be charged to and paid by the Contractor at once and/or the Owner may set-off such amount against any monies payable to the Contractor or performance security.

3.17 ACCESS TO WORK

The Owner reserves the right to have access to the Work in preparation and progress wherever located, and the Contractor shall cooperate in providing such access.

3.18 ROYALTIES AND PATENTS

The Contractor shall pay all royalties and license fees. The Contractor shall defend suits or claims for infringement of patent rights and shall indemnify, defend, and hold the Owner 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. However, if the Contractor has reason to believe or should have known that the required design, process or product is an infringement of a patent or other intellectual property right, the Contractor shall be responsible for such loss unless such information is promptly furnished, in writing, to the Owner.

3.19 INDEMNIFICATION

3.19.1 To the fullest extent permitted by law, the Contractor shall be responsible for and shall defend, indemnify, and hold the Owner, its elected officials, officers, employees, and volunteers and the time cost of Owner's elected officials, officers, employees, and volunteers harmless from and against claims, damages, losses and expenses, including but not limited to attorneys' fees, arising out of or resulting from any intentional or negligent act or omission or failure to perform, or amount or character of the Work, 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 including loss of use resulting therefrom. Such obligation shall not be construed to negate, abridge, or reduce other rights or obligations or indemnity which would otherwise exist as to a party or person described in this Paragraph 3.19.

3.19.2 In claims by an employee of the Contractor, a Subcontractor, anyone directly or indirectly employed by them or anyone for whose acts they may be liable against any person or entity to be indemnified under this Paragraph 3.19, the indemnification obligation 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' or workmen's compensation acts, disability benefit acts or other employee benefit acts.

3.20 INTERFERENCE WITH EXISTING STRUCTURES

3.20.1 Subsurface structures encountered in the prosecution of the Work shall be protected and maintained in complete operation, unless permission for their removal is given. It is the duty of the Contractor to locate and become informed about the existence of such structures before beginning the Work.

3.20.2 In case the uncovering of subsurface structures necessitates a change in the alignment or grade of the proposed work, the Contractor shall give

written notice of such obstruction, and shall cease work at such points until ordered to proceed.

- 3.20.3 The Contractor has considered in its bid all of the permanent and temporary utility facilities in their present or relocated positions; and the Contractor, as part of this Contract, will coordinate utility construction and relocation with its construction operations. Contractor shall comply with all applicable laws, rules, and regulations including, but not limited to Ohio Revised Code Section 153.64, for contacting the Ohio Utilities Protection service before commencing work and the Contractor shall notify all the government departments and public utilities whose wires, pipes, conduits or other structures may be affected by Contractor's operations.

3.21 INTERFERENCE WITH EXISTING TRAFFIC

3.21.2 At least forty-eight (48) hours before commencing work the Contractor shall notify the City Fire and Police Departments of the temporary blocking of any street.

3.21.3 During the progress of the work, the Contractor shall accommodate both vehicular and foot traffic; street intersections may be blocked, but only one-half at a time and only to the extent allowed by the City.

3.21.4 It shall be the responsibility of the Contractor to cooperate fully with the Engineering, Police and Fire Departments of the City and to maintain at least one-way traffic in construction areas if at all possible. Where this is not possible, barricades and warning devices complying with the Ohio Uniform Manual of Traffic Control Devices shall be furnished, erected and maintained by the Contractor after notification and approval by the City.

3.22 INSPECTION AND MATERIAL

3.22.1 No material of any kind may be used, nor will any Work be deemed to be complete, until it has been inspected and accepted by the Owner.

3.22.2 The Contractor must furnish all labor necessary in handling such material for inspection.

3.22.3 All materials rejected must be immediately hauled away from the vicinity of the Work.

3.22.4 Materials or workmanship found at any time to be defective shall be remedied immediately by the Contractor, regardless of previous inspections.

3.22.5 Products or materials not pre-approved by the Owner cannot be used on this Project. In order to test and evaluate new products and materials, a part of the Project may be designated as a "test section" by the Owner.

3.22.6 Products accepted for evaluation shall meet the required specifications and an independent laboratory shall submit test results to the City prior to incorporation into the Project.

- 3.22.7 The Contractor or its subcontractor or their supplier shall be responsible for testing or additional reports as requested by the Owner.
- 3.22.8 Acceptance or rejection by the Owner of the product or material will be made after sufficient time has lapsed to permit proper analysis of the "test section".
- 3.22.9 The Owner's designees, together with other parties who may enter into contracts with the Owner for doing work within the territory covered by this Contract, shall, for all purposes which may be required by their contracts, have access to the work and the premises used by the Contractor; and the Contractor shall provide safe and proper facilities therefore. Furthermore, the Owner and its designees shall at all times have immediate access to all places of manufacture where materials are being made for use under this Contract and shall have full facilities for inspecting the same.
- 3.22.10 The field inspection of the Work, field checking of materials, giving of lines and grades, together with the preparation of partial and final estimates, will be done by the Owner.

3.23 LAWS AND REGULATIONS

- 3.23.1 The Contractor shall keep itself fully informed of all federal or state laws, municipal ordinances, and regulations in any manner affecting those engaged or employed in the Work or the materials used in the work, or in any way affecting the contract of the Work and of all orders and decrees of bodies or tribunals having any jurisdiction or authority over the same.
- 3.23.2 The Contractor shall also observe and comply with, and shall cause all its agents, employees and subcontractors to observe and comply with all such existing and future laws, ordinances, regulations, orders, and decrees, and to protect and to indemnify, defend and hold the Owner harmless against any claim or liability arising from or based on the violation of such laws, ordinances, regulations, orders or decrees by itself, its agents, employees or subcontractors.

3.24 RIGHTS OF WAY

The Owner will be responsible for the securing of all necessary rights of way and easements. Care shall be taken by the Contractor to avoid injury to any private or public premises entered and all such premises shall be left in neat and orderly condition.

3.25 SUBLETTING OR ASSIGNING

- 3.25.1 The Contractor shall give Contractor's personal attention to the faithful prosecution of the work, shall keep the same under Contractor's personal control, and shall not assign by power of attorney or otherwise, nor sublet the work or any part thereof, without the previous consent of the Owner, in writing, to each named assignee and subcontractor and shall not, either legally or equitably, assign any money payable under this agreement, or its claim thereto, unless by and with the prior express consent of the Owner in writing. (See also 5.2.)
- 3.25.2 Neither assignment or subletting the whole or any portion of this Contract, nor any approved by the Owner of any assignee or subcontractor, shall operate to release the Contractor or Contractor's surety hereunder from any of the contractual or statutory obligations, nor shall due care in selecting assignees or subcontractors.

3.26 MEASUREMENTS

- 3.26.1 Where the computation of areas or volumes by exact geometric methods is unduly laborious or refined, the planimeter will suffice as an instrument of precision and will be used in the determination of quantities upon which payments are based. The measurements of the Owner as to the amount of the Work done shall be final and conclusive.
- 3.26.2 Payments will be made for Work done within the lines prescribed by the Specifications, and in accordance with any applicable Unit Prices for such Work.

3.27 NO ESTOPPEL OR WAIVER

- 3.27.1 The Owner shall not be precluded or estopped by any return or certificate made or given by it, from at any time, either before or after the final completion and acceptance of the Work and payment made therefore,
- 3.27.1.1 Showing true and correct amount and character of the Work done and materials furnished by the Contractor or any other person; or
- 3.27.1.2 Showing at any time that any such return or certificate is untrue and incorrect or improperly made in any particular, or that the Work or materials or any part thereof do not in fact conform to the specifications; or
- 3.27.1.3 Demanding and recovering from the Contractor such damages as the Owner may sustain by reason of failure to comply with the Specifications.

- 3.27.2 Neither acceptance by the Owner, nor any order, measurements, or certificate by the Owner, nor any order for payment of money, nor any payment for nor acceptance of the whole or any part of the Work by the Owner, nor any possession taken by the Owner or its employees, shall operate as a waiver of any portion of this Contract or a waiver or an estoppel of any power herein reserved to the Owner or any rights to damages. No waiver of any breach of this Contract be held to be a waiver of any other or subsequent breach.

4. **ADMINISTRATION OF THE CONTRACT**

4.1 **OWNER'S ADMINISTRATION OF THE CONTRACT**

- 4.1.1 The Owner will provide administration of the Contract as described in the Contract Documents.
- 4.1.2 The Owner reserves the right to visit the site at intervals appropriate to the stage of construction to become generally and/or specifically familiar with the progress and quality of the completed Work and to determine in general, and/or as to any specific matters, if the Work is being performed in a manner indicating that the Work, when completed, will be in accordance with the Contract Documents. The Owner will not be required, but reserves the right, to make any on-site inspections to check quality or quantity of the Work, but such inspections shall not relieve Contractor's duty to use correct quality and quantity.
- 4.1.3 The Owner will not have control over or charge of and will not be responsible for construction means, methods, techniques, sequences or procedures, or for safety precautions and programs in connection with the Work, since these are solely the Contractor's responsibility. The Owner will not be responsible for the Contractor's failure to carry out the Work in accordance with the Contract Documents. The Owner 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 of any other persons performing portions of the Work (other than employees of the Owner).
- 4.1.4 The Contractor and the Owner shall endeavor to communicate through the Owner's representative and the Contractor's supervisor/representative. Communications by and with Subcontractors and material suppliers shall be through the Contractor. Communications with any separate contractor shall be through the Owner.
- 4.1.5 Based on the Owner's observations and evaluations of the Work and Contractor's Applications for Payment, the Owner will review and determine the amounts due the Contractor and will pay such amounts. No payment will be made for rejected Work.

- 4.1.6 The Owner will have authority to reject Work which does not conform to the Contract Documents. Whenever the Owner considers it necessary or advisable for implementation of the intent of the Contract Documents, the Owner will have authority to require additional inspection or testing of the Work, whether or not such Work is fabricated, installed or completed. However, neither this authority of the Owner 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 Owner to the Contractor, Subcontractors, material and equipment suppliers, their agents or employees, or other persons performing portions of the Work.
- 4.1.7 The Owner 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. 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 Owner's review of the Contractor's submittals shall not relieve the Contractor of any of Contractor's obligations under the Contract. The Owner's review shall not constitute approval of safety precautions or of any construction means, methods, techniques, sequences or procedures. The Owner's approval of a specific item shall not indicate approval of an assembly of which the item is a component.
- 4.1.8 The Owner will prepare Change Orders and may authorize minor changes in the Work as provided elsewhere in the Contract.
- 4.1.9 The Owner will conduct inspections to determine the date or dates of Substantial Completion and the date of final completion and will issue final payment upon compliance by the Contractor with requirements of the Contract Documents to the satisfaction of the Owner.
- 4.1.10 The Owner will interpret and decide matters concerning performance under and requirements of the Contract Documents on written request of the Contractor. The Owner's response to such requests will be made with reasonable promptness and within fifteen (15) days after written request is made for them.
- 4.1.11 Interpretations and decisions of the Owner will be in writing or in the form of drawings. When making such interpretations and decisions, the Owner will not be liable for results of interpretations or decisions so rendered in good faith.
- 4.1.12 The Owner's decisions on matters relating to aesthetic effect will be final as long as not in conflict with any express and specific provision of the Contract Documents.

4.2 CLAIMS AND DISPUTES

- 4.2.1 **Definition.** A Claim is a demand or assertion by one of the parties seeking, as a matter of right, adjustment or interpretation of Contract terms, payment of money, extension of time 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. Claims must be made by written notice. The responsibility to substantiate Claims shall rest with the party making the Claim.
- 4.2.2 **Time Limits on Claims.** Claims by either party must be made with twenty-one (21) days after occurrence of the event giving rise to such Claim or within twenty-one (21) days after the claimant first recognizes the condition giving rise to the Claim, whichever is later. Claims must be made by written notice. An additional Claim made after the initial Claim has been implemented by Change Order will not be considered unless submitted in a timely manner. Other terms and conditions in the Contract Documents may set other time limits for specific types of claims, and such other time limits shall prevail over the general time rules of this Subparagraph 4.2.2.
- 4.2.3 **Continuing Contract Performance.** Pending final resolution of a Claim, unless otherwise agreed in writing or unless the claim is made the subject of a court action filed by either party, the Contractor shall proceed diligently with performance of the Contract and the Owner shall continue to make payments in accordance with the Contract Documents.
- 4.2.4 **Waiver of Claims: Final Payment.** The making of final payment shall constitute a waiver of Claims by the Owner except those arising from:
- 4.2.4.1 Liens, Claims, security interests or encumbrances arising out of the Contract and unsettled;
 - 4.2.4.2 Failure of the Work to comply with the requirements of the Contract Documents; or
 - 4.2.4.3 Terms of warranties required by law or the Contract Documents.
- Acceptance of final payment by Contractor shall constitute waiver of claims by the Contractor.
- 4.2.5 **Claims for Concealed or Unknown Conditions.** If conditions are encountered at the site which are (1) subsurface or otherwise concealed physical conditions which differ materially from those indicated in the Contract Documents or (2) such conditions which differ materially from those that would have been revealed by diligent site inspection and testing by the Contractor, the Contractor shall give notice to the Owner promptly before such conditions are disturbed and in no event later than five (5) days after first observance of the conditions. The Owner will promptly investigate such conditions and, if Owner determines, in Owner's sole discretion, 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, the Owner will make equitable adjustment in the Contract Sum or Contract Time, or both, or terminate or cancel the Contract. If the Owner determines that conditions at the site are not materially different and that no change in the terms of the Contract is justified, the Owner shall so notify the Contractor in writing. Claims in opposition to such determination must be made within five (5) days after the Owner has given notice of the decision.

4.2.6 **Claims for Additional Cost.** If the Contractor wishes to make a Claim for an increase in the Contract Sum, written notice shall be given to the Owner before proceeding to execute the Work. Prior notice is not required for Claims relating to an emergency endangering life or property. If the Contractor believes additional cost is involved for reasons including but not limited to (1) a written interpretation from the Owner, (2) an order by the Owner to stop the Work where the Contractor was not at fault, (3) a written order for a minor change in the Work issued by the Owner, (4) failure of payment by the Owner, (5) termination of the Contract by the Owner, or (6) Owner's suspension, Claim shall be filed in accordance with the procedure established in subparagraph 4.2.2.

4.2.7 **Claims for Additional Time.**

4.2.7.1 If the Contractor wishes to make Claim for an increase in the Contract Time, written notice as provided herein shall be given as provided in subparagraph 4.2.2. 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.

4.2.7.2 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 and could not have been reasonably anticipated, and that weather conditions had an adverse effect on the scheduled construction.

4.2.8 **Injury or Damage to Person or Property.** If either party to the Contract suffers injury or damage to person or property (of some type other than claims referred to earlier in this section) because of an act or omission of the other party, of any of the other party's employees or agents, or of others for whose acts such party is legally liable, written notice of such injury or damage, whether or not insured, shall be given to the other party within a reasonable time not exceeding twenty-one (21) days after first observance. The notice shall provide sufficient detail to enable the other party to investigate the matter. If a Claim for additional cost or time related to this Claim is to be asserted, it shall be filed as provided in Subparagraphs 4.2.2.

4.3 RESOLUTION OF CLAIMS AND DISPUTES

- 4.3.1 The party against or to whom a Claim is made shall review that Claim within ten (10) days after receiving it and will take one or more of the following actions within that time: (1) request additional supporting data from the claimant; (2) notify the claimant that a decision can be expected within some additional time, not to exceed fifteen (15) more days; (3) reject the claim in whole or in part, stating reasons for the rejection; or (4) suggest a compromise. The Contractor's surety may be notified by the Owner as to any Claim against or to the Contractor.
- 4.3.2 If any claim is not settled after following the procedures of subparagraph 4.3.1, the claimant may make the claim the subject of a court action against the other party.
- 4.3.3 The remedies provided in this Agreement are cumulative. Delay or forbearance in the enforcement of any right under this Agreement shall not be deemed a waiver of, or estoppel against the exercise of, such right.

5. SUBCONTRACTORS

5.1 AWARD OF SUBCONTRACTS AND OTHER CONTRACTS FOR PORTIONS OF THE WORK

- 5.1.1 The Owner is relying upon the personal skill, experience and attention of the Contractor being given to the faithful prosecution of the Work; and the Contractor shall neither assign all or any part of the Contract of which these General Conditions are a part, nor sublet all or any portion of the Work, without the prior written approval of the Owner.
- 5.1.2 Unless otherwise stated in the Contract Documents or the bidding requirements, the Contractor, as soon as practicable after notification of selection for the award of the Contract, shall furnish in writing to the Owner the names of persons or entities (subcontractors) the Contractor proposes for each principal portion of the Work. The Owner has the right to reject any proposed subcontractor in writing. Failure of the Owner to reply promptly shall constitute notice of no objection.
- 5.1.3 The Contractor shall not subcontract with a proposed person or entity to whom the Owner has made such timely objection. The Contractor shall not be required to contract with anyone to whom the Contractor has made reasonable objection. Failure of the Owner to exercise its right to object to any Subcontractor shall not relieve the Contractor from liability for the Subcontractor failing to perform its work completely, in a timely manner, and correctly.

5.1.4 If the Owner objects to a person or entity proposed by the Contractor, the Contractor shall propose another to whom the Owner has no objection. The Contract Sum may be increased or decreased by the difference in cost occasioned by such change and an appropriate Change Order shall be issued or the Contract can be terminated by the Owner. However, no increase in the Contract Sum shall be allowed for such change unless the Contractor has acted promptly and responsively in submitting names as required.

5.1.5 The Contractor shall not change a Subcontractor, person or entity previously selected if the Owner objects to such change.

5.2 **SUBCONTRACTUAL RELATIONS**

By written agreement acceptable to Owner, 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 which the Contractor, by these Documents, assumes toward the Owner. Each subcontract agreement shall preserve and protect the rights of the Owner under the Contract Documents with respect to the Work to be performed by the Subcontractor so that subcontracting thereof will not prejudice such rights. 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 which may be at variance with the Contract Documents. Subcontractors shall similarly make copies of applicable portions of such documents available to their respective proposed Sub-subcontractors.

5.3 **CONTINGENT ASSIGNMENT OF SUBCONTRACTS**

5.3.1 Each subcontract agreement for a portion of the Work is assigned by the Contractor to the Owner provided that:

5.3.1.1 Assignment is effective only after termination of the Contract by the Owner for cause as provided for in the Contract Documents;

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

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.

- 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 when directed to do so. 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.

6.2 **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 Owner discrepancies or defects in such other construction that would render it unsuitable for such proper execution and results which are apparent or which the Contractor should have been aware in the exercise of due diligence. Failure of the Contractor so to report shall constitute an acknowledgment that the Owner's or separate contractors' completed or partially completed construction is fit and proper to receive the Contractor's Work, except as to defects not then reasonably discoverable through due diligence.
- 6.2.3 Costs caused by delays or by improperly timed activities or defective construction shall be borne by the party responsible therefore.
- 6.2.4 The Contractor shall promptly remedy damage wrongfully caused by the Contractor to completed or partially completed construction or to property of the Owner or separate contractors.
- 6.2.5 Claims and other disputes and matters in question between the Contractor and a separate contractor shall be subject to the provisions of Paragraph 4.3 provided the separate contractor has reciprocal obligations.

7. CHANGES IN THE WORK

7.1 CHANGES

- 7.1.1 The Owner has the unilateral right to make changes in the Work by altering it, by adding additional items to it, or by deleting items from it, subject to the limitation that the amount of Work to be performed may not be increased or decreased by more than forty percent (40%) (measured by increases or decreases reasonably required to be made to the Contract Sum) without the Contractor's written consent. Reasonable adjustments to the Contract Sum and to the Contract Time shall be made to reflect such changes in the Work. Those adjustments to the Contract Sum shall be made as provided below in this Article 7.
- 7.1.2 Changes in the Work may be accomplished in the following ways after execution of the Contract, and without invalidating the Contract (1) by written Change Order as described in Paragraph 7.2 below or (2) by written order for a minor change in the Work as described in Paragraph 7.3 below, subject to the limitations stated in this Article 7 and elsewhere in the Contract Documents.
- 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 or order for a minor change in the Work.
- 7.1.4 If unit prices are stated in the Contract Documents or subsequently agreed upon, and if quantities originally contemplated are so changed in a proposed Change Order that application of such unit prices to quantities of Work proposed will cause substantial inequity to the Owner or Contractor, the applicable unit prices shall be equitably adjusted.
- 7.1.5 The cost of any change order shall not exceed the actual labor and material cost directly incurred for the change, plus the overhead and profit as bid by the contractor on the bid proposal page submitted.

7.2 MODIFICATION

The Contract Documents can only be modified by a written instrument signed on behalf of both Contractor and Owner.

7.3 MINOR CHANGES IN THE WORK

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 shall be effected by written order and shall be binding on the Owner and Contractor. The Contractor shall carry out such written orders promptly.

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 Completion of the Work.
- 8.1.2 The date of commencement of the Work is the date established in the Agreement. The date shall not be postponed by the failure to act of the Contractor or of persons or entities for whom the Contractor is responsible.
- 8.1.3 The date of Substantial Completion is the date certified by the Owner in accordance with Paragraph 9.7.
- 8.1.4 The term "day" as used in the Contract Documents shall mean calendar day unless otherwise specifically defined.

8.2 PROGRESS AND COMPLETION

- 8.2.1 Time limits stated in the Contract Documents are of the essence to the Owner. By executing the Agreement, the Contractor confirms that the Contract Time is a reasonable period for completing the Work.
- 8.2.2 The Contractor shall not knowingly, 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. The date of commencement of the Work shall not be changed by the effective date of such insurance. Unless the date of commencement is established by a notice to proceed given by the Owner, the Contractor shall notify the Owner in writing not less than five (5) days or other agreed period before commencing the Work to permit the timely filing of mortgages, mechanic's liens and other security interests.
- 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 progress of the Work by an act or neglect of the Owner or of a separate contractor employed by the Owner, or by changes ordered in the Work, or by labor disputes, fire, unavoidable casualties or other causes which were not reasonably foreseeable and were also beyond the Contractor's control, or by other causes which the Owner reasonably determines may justify delay (with the Contractor having a duty to exert good faith best efforts to counteract the effect of causes which might otherwise have caused delay), then the Contract Time shall be extended by Change Order for such reasonable time as the Owner may determine. The fact that the Contractor is working for or has completion obligations to other owners shall not, however, justify delay under this Contract.

8.3.2 Claims relating to time shall be made in accordance with applicable provisions of Subparagraph 4.2.7, except as provided in Paragraph 8.4 below.

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

8.4 **FAILURE TO COMPLETE ON TIME**

8.4.1 Time is of the essence in Contractor's prosecution and completion of the Work. For each day that any work shall remain uncompleted after the contract completion date or extended date, the sum specified herein will be deducted from any money due the Contractor, not as a penalty but as liquidated damages.

8.4.2 Permitting the Contractor to continue and finish the work or any part of it after the date fixed for its completion or after the date to which completion may have been extended, will in no way operate as a waiver on the part of the Owner of any of its rights under the Contract.

8.4.3 The Owner may waive such portions of the liquidated damages that may accrue after the work is in condition for safe and convenient use.

8.4.4 Liquidated Damages

The Contractor shall pay to the owner the sum of \$1,000 each calendar day of overrun as liquidated damages.

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**

Before the first Application for Payment, the Contractor shall submit to the Owner a schedule of values allocated to various portions of the Work, prepared in such form and supported by such data to substantiate its accuracy as the Owner may require.

This schedule protects the parties by identifying that part of the Contract Sum attributable to various parts of the work. It assists in preventing a situation in which the Contractor's Applications for Payment call for disbursement of so much money that the Contract Sum is paid or requested while parts of the Work remains uncompleted. This schedule, unless objected to by the Owner, shall be used as a basis for reviewing the Contractor's Applications for Payment, but if actual construction practices or on-site inspections subsequently show the schedule not to be correct, it shall be revised and made accurate before use in connection with such Applications for Payment.

9.3 APPLICATIONS FOR PROGRESS PAYMENTS

- 9.3.1 At least ten (10) days before the date established for each progress payment, the Contractor shall submit to the Owner an itemized Application for Payment for operations completed in accordance with the schedule of values. Such application shall be made only when, and shall declare that, the part of the Work it covers has been completed in compliance with requirements of the Contract Documents. Each application shall be sworn to under oath by the Contractor, and shall be notarized and supported by such data substantiating the Contractor's right to payment as the Owner may require, such as copies of requisitions from Subcontractors and material suppliers. The application shall also show the retainage amount to be withheld by the Owner, if provided for elsewhere in the Contract Documents.
- 9.3.1.1 Such applications may include requests for payment on account of changes in the Work which have been properly authorized by Change Orders. Every Application for Payment shall be deemed to request payment to the Contractor and/or to Subcontractors and material suppliers who are owed money for the Work included in that application. No language in an application shall change this principle; the Owner shall have the right to make payment in that manner, as by joint or multiple payee checks naming the Contractor and various Subcontractors and/or suppliers; and payment to such persons shall be deemed payment to the Contractor.
- 9.3.1.2 Such applications may not include requests for payment of amounts the Contractor does not intend to pay to a Subcontractor or material supplier because of a dispute or other reason.
- 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. The Owner shall have the right, but shall not be required, to issue payments 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 satisfactory assurance or security for payment by the Contractor of insurance, storage and transportation to the site for such materials and equipment stored off the site. When such payment is made, those materials and equipment shall be deemed to have become property of the Owner, but the Contractor shall still have the burden of protecting and insuring the Owner's interest and paying for storage and transportation, as described above in this subparagraph.

9.3.3

9.3.1.1 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 payments have been made by 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 or equipment relating to the Work.

9.3.1.2 The same warranty shall apply to the Work then covered by the pending Application for Payment, once the Owner has issued payment requested by that Application. To satisfy this warranty, the Contractor must include as part of each Application for Payment conditional release of claims and lien rights signed by the Contractor and by all Subcontractors and material suppliers. The condition shall be that a release is not valid unless that Subcontractor or material supplier has been paid a sum stated in the release, which sum is explained in the release as including all claims the Subcontractor or material supplier has for Work included in that application. That Work must be identified so both the Owner and such Subcontractors and suppliers are able to determine what is covered by the application.

9.3.1.3 In addition, the Contractor must also complete and include as part of each such application the standard Contractor's Affidavit, and must obtain and submit similar affidavits from all Subcontractor and material supplier statements, all as provided for in the Ohio Mechanic's Lien laws. No application may be submitted, regardless of any contrary language in the Contract Documents, until all laborers have been paid in full for their part of the Work covered by the application.

9.3.4 Payments

9.3.4.1 The payment for work done under any item contained in the proposal or in any supplementary contract shall cover the furnishing of all labor, equipment and materials necessary for the construction and completion of such item.

9.3.4.2 If the Contractor proceeds satisfactorily with the work under this Contract and complies with all the terms and conditions thereof, estimates of the work done may be made by the Contractor monthly, and upon approval by the City, ninety percent (90%) of the total cost at contract rates of the work thus estimated, less the amounts already paid, shall be paid to the Contractor in accordance with the application procedure for progress payments, referred to in subparagraph 9.3.1.

- 9.3.4.3 In making such estimates, the Contractor shall not take into consideration any materials which have not been placed in the improvements and shall include release of liens for all labor and materials included in the estimate.
- 9.3.4.4 Such payments shall not be an acceptance of the work done, and no work shall be accepted until the work contracted for is fully completed. Upon completion of fifty percent (50%) of the estimated contract sum, the City may at its discretion pay the Contractor an amount equivalent to ninety-five percent (95%) of the estimate made for all succeeding payments.
- 9.3.4.5 After all Work has been completed to the satisfaction of the City, the Contractor shall submit a request for acceptance by the City. The Contractor shall provide a release of liens against the funds from Contractor and all subcontractors prior to acceptance of the project. The City upon accepting the project shall cause to be paid 100% of the value, at contract rates, the amount of work shown by the Contractor's certificate of total cost, less the amounts already paid on monthly estimates and any setoffs allowed under the Contract Documents.

9.4 **DECISIONS TO WITHHOLD PAYMENT**

9.4.1 The Owner may withhold payment in whole or in part, if in the Owner's opinion (1) the representations made in the Application for Payment are not correct or (2) if the Work has not been properly completed to the point indicated in the Application for Payment. If so, the Owner will notify the Contractor. If the Contractor and the Owner cannot agree on a revised amount, the Owner will make payment for the amount which the Owner believes to be correct payment for Work properly completed in accordance with the Contract Documents. The Owner may also decide not to make payment or, because of subsequently discovered evidence or subsequent observations, may nullify the whole or a part of a payment previously issued because of:

- 9.4.1.1 Defective Work not remedied;
- 9.4.1.2 Third party claims filed or reasonable evidence indicating probable filing of such claims;
- 9.4.1.3 Failure of the Contractor to make payments properly to Subcontractors or for labor, materials or equipment;
- 9.4.1.4 Reasonable evidence that the Work cannot be completed for the unpaid balance of the Contract Sum;
- 9.4.1.5 Damage to the Owner or another contractor;

9.4.1.6 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; or

9.4.1.7 Persistent failure to carry out the Work in accordance with the Contract Documents.

9.4.2 When the above reasons for withholding payment are removed, payment will be made for amounts previously withheld.

9.5 **PROGRESS PAYMENTS**

9.5.1 Payments made as the Work progresses and before it is completed are called Progress Payments.

9.5.2 The Contractor shall promptly pay each Subcontractor, upon receipt of payment from the Owner, out of the amount paid to the Contractor on account of such Subcontractor's portion of the Work, the amount to which said Subcontractor is entitled, reflecting percentages actually retained from payments to the Contractor on account of such 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 similar manner. In the alternative, the Owner may make distribution of money directly to subcontractors and material suppliers, or jointly to them and the Contractor, as is provided in subparagraph 9.3.1.1 and in subparagraph 9.5.4 below.

9.5.3 The Owner 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 Owner on account of portions of the Work done by such Subcontractor.

9.5.4 The Owner shall not have an obligation to pay or to see to the payment of money to a Subcontractor except as may otherwise be required by law, but the Owner shall have the right to pay Subcontractors and material suppliers directly in the amounts listed on their conditional lien release and shall have the right to make similar payment through joint payee checks to the Contractor and any Subcontractor and/or material suppliers, with either form of payment to be counted as payment to the Contractor (see Paragraph 9.3.1.1). Such amounts paid by Owner shall be deducted from the Contract Sum to be paid to Contractor.

9.5.5 Payment to material suppliers shall be treated in a manner similar to that provided in Subparagraphs 9.5.2, 9.5.3 and 9.5.4.

9.5.6 Neither any progress nor final payment or partial or entire use or occupancy of the Project by the Owner shall constitute acceptance of Work not in accordance with the Contract Documents.

9.6 SUBSTANTIAL COMPLETION

- 9.6.1 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 the Owner can occupy or utilize the Work for its intended use.
- 9.6.2 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 Owner a comprehensive list of items to be completed or corrected. The Contractor shall proceed promptly to complete and correct items on the list. 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. Upon receipt of the Contractor's list, the Owner will make an inspection to determine whether the Work or designated portion thereof is substantially complete. If the Owner's inspection discloses any item, whether or not included on the Contractor's list, which is not in accordance with the requirements of the Contract Documents, the Contractor shall complete or correct such item upon notification by the Owner. The Contractor shall then submit a request for another inspection by the Owner to determine Substantial Completion. When the Work or designated portion thereof is substantially completed in the reasonable judgment of the Owner, the Owner will prepare a Certificate of Substantial Completion which shall fix the time within which the Contractor shall finish all items on the list accompanying the Certificate. The Contractor shall continue to have responsibility for security, maintenance, heat, utilities, damage to Work and insurance for any part of the Work not occupied or not used in a substantial manner by the Owner, whether or not substantially completed. This non-occupancy or non-use responsibility of Contractor shall continue until the Work is totally completed to the satisfaction of the Owner or until that part of the Work is occupied or is used in a substantial manner by the Owner. Warranties required by the Contract Documents shall commence on the date the owner takes full and complete possession and/or uses all the Work in a substantial manner. The Certificate of Substantial Completion shall be submitted to the Contractor so as to inform the Contractor of responsibilities assigned to it in such Certificate.
- 9.6.3 Upon Substantial Completion of the Work or designated portion thereof and upon application by the Contractor and such certification by the Owner, the Owner shall make payment, reflecting adjustments in retainage, if any, for such Work or portion thereof as provided in the Contract Documents.

9.7 **PARTIAL OCCUPANCY OR USE**

- 9.7.1 The Owner may occupy or use any completed or substantially completed part of the Work.

Further, the Owner may occupy or use any portion of the Work not yet substantially completed, under a separate written agreement with the Contractor, provided such occupancy or use is authorized by public authorities having jurisdiction over the Work. Such occupancy or use of Work not substantially complete may commence, provided the Owner and Contractor have accepted in writing the responsibilities assigned to each of them for payments, security, maintenance, heat, utilities, damage to the Work and insurance, and have agreed in writing concerning the period for correction, commencement of warranties required by the Contract Documents and completion of the Work. Consent of the Contractor to such occupancy or use shall not be unreasonably withheld.

- 9.7.2 Immediately prior to such occupancy or use, the Contractor and Owner 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.

- 9.7.3 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.

9.8 **FINAL COMPLETION AND FINAL PAYMENT**

- 9.8.1 Upon receipt of written notice that the Work is ready for final inspection and acceptance and upon receipt of a final Application for Payment, the Owner will promptly make such inspection and, when the Owner finds the Work acceptable under the Contract Documents and the Contract fully performed, the Owner will proceed to make final payment.

9.8.2 Neither final payment nor any remaining retained percentage shall become due, however, until the Contractor submits to the Owner (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 of insurance 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 thirty (30) 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, and (5) other data establishing payment or satisfaction of obligations, such as receipts, releases, Contractor's affidavit, certificates of material suppliers, 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. 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 attorneys' reasonable fees.

9.8.3 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. Such waivers shall be in addition to the waiver described in Subparagraph 4.2.4.

10. PROTECTION OF PERSONS AND PROPERTY

10.1 SAFETY PRECAUTIONS AND PROGRAMS

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

10.1.2 In the event the Contractor encounters on the site material reasonably believed to be asbestos or polychlorinated biphenyl (PCB) which has not been rendered harmless, the Contractor shall immediately stop Work in the area affected and report the condition to the Owner in writing. The Work in the affected area shall not thereafter be resumed except by written agreement of the Owner and Contractor if in fact the material is asbestos or polychlorinated biphenyl (PCB) and has not been rendered harmless. The Work in the affected area shall be resumed in the absence of asbestos or polychlorinated biphenyl (PCB), or when it has been rendered harmless.

10.2 SAFETY OF PERSONS AND PROPERTY

- 10.2.1 The Contractor shall take, and shall require all subcontractors to take, reasonable precautions for safety of, and shall provide reasonable protection to prevent damage, injury or loss to:
- 10.2.1.1 Employees on the Work and other persons who may be affected thereby;
 - 10.2.1.2 The Work and materials and equipment to be incorporated therein, whether under care, custody or control of the Contractor or the Contractor's Subcontractors or Sub-subcontractors;
 - 10.2.1.3 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;
 - 10.2.1.4 All other property affected by performance or preparation for the Work, whether on or off site.
- 10.2.2 The Contractor shall give notices and comply with applicable laws, ordinances, rules, 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 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 (more than reasonable) care and carry on such activities under supervision of properly qualified personnel.
- 10.2.5 The Contractor shall promptly remedy, repair and repay damage and loss (other than damage or loss insured under property insurance required by the Contract Documents) to property referred to in subparagraphs 10.2.1.2, 10.2.1.3. and 10.2.1.4 caused in whole or in part by the Contractor, a Subcontractor or anyone employed by or an agent of either or for whose acts either may be liable, except damage or loss solely attributable to negligent acts or omissions of the Owner or anyone directly or indirectly employed by the Owner, or by anyone for whose acts it may be liable, and not attributable in part to the fault or negligence of the Contractor. The foregoing obligations of the Contractor are in addition to the Contractor's obligations under Paragraph 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 designed by the Contractor in writing to the Owner.

10.2.7 The Contractor shall not load or permit any part of the construction or site to be loaded so as to endanger its safety.

10.3 EMERGENCIES

In an emergency affecting safety of persons or property, the Contractor shall act to prevent threatened damage, injury or loss. Additional compensation or extension of time claimed by the Contractor on account of an emergency, to the extent Contractor was not partially or wholly responsible for the emergency and to the extent the emergency was not reasonably foreseeable by Contractor the Contractor has gone beyond Contractor's duty to provide safeguards and to remedy, repair and repay loss or damage as required by this Article, shall be determined as provided in Paragraph 4.2 and Article 7.

11. INSURANCE

Contractor shall procure and maintain for the duration of the contract, and for 3 years thereafter, insurance against claims for injuries to persons or damage(s) to property which may arise from or in connection with the performance of the work performed by the Contractor, Contractor's agents, representatives, employees, or subcontractors.

11.1. Minimum Scope and Limit of Insurance:

11.1.1 Coverage shall be at least as broad as:

- A. Commercial General Liability (CGL): Insurance Services Office Form CG 00 01 covering CGL on an "occurrence" basis, including products and completed operations, property damage, bodily injury and personal & advertising injury with limits no less than \$1,000,000 per occurrence. If a general aggregate limit applies, either the general aggregate limit shall apply separately to this project/location or the general aggregate limit shall be twice the required occurrence limit.
- B. Automobile Liability: Insurance Services Office Form Number CA 0001 covering Code 1 (any auto), with limits no less than \$1,000,000 per accident for bodily injury and property damage.
- C. Workers' Compensation insurance as required by the State of Ohio, with Statutory Limits, and Employers' Liability insurance with a limit of no less than \$1,000,000 per accident for bodily injury or disease. *(Not required if contractor provides written verification it has no employees.)*
- D. Builder's Risk (Course of Construction) insurance (for construction/remodeling projects) utilizing an "All Risk" (Special Perils) coverage form, with limits equal to the completed value of the project and no coinsurance penalty provisions.
- E. Professional Liability Professional Liability (Errors and Omissions) insurance appropriate to the Contractor's profession (if Contractor is providing professional services), with limits no less than \$1,000,000 per occurrence or claim, \$2,000,000 aggregate.

F. Contractors' Pollution Legal Liability and/or Asbestos Legal Liability and/or Errors and Omissions insurance (if project involves environmental hazards) with limits no less than \$1,000,000 per occurrence or claim, and \$2,000,000 policy aggregate.

11. 1.2 If the Contractor maintains higher limits than the minimums shown above, the City requires and shall be entitled to coverage for the higher limits maintained by the Contractor. Any available insurance proceeds in excess of the specified minimum limits of insurance and coverage shall be available to the City.

11.1.3 Deductibles and Self-Insured Retentions: Any deductibles or self-insured retentions must be declared to and approved by the City. At the option of the City, either: the Contractor shall cause the insurer to reduce or eliminate such deductibles or self-insured retentions as respects the City, its officers, officials, employees, and volunteers; or the Contractor shall provide a financial guarantee satisfactory to the City guaranteeing payment of losses and related investigations, claim administration, and defense expenses. Deductibles shall not exceed \$25,000.00.

11.1.4 No Reduction or Limit of Obligation: By requiring insurance, the City does not represent that the required insurance coverage and limits will necessarily be adequate to protect the Contractor. Insurance affected or procured by the Contractor will not reduce or limit the Contractor's contractual obligation to indemnify and defend the City for claims or suits which result from or are connected with the performance of the contract.

11.2 Other Insurance Provisions

11.2.1 The insurance policies shall contain, or be endorsed to contain, the following provisions:

- A. The City, its officers, officials, employees, and volunteers shall be covered as additional insureds on the CGL policy with respect to liability arising out of work or operations performed by or on behalf of the Contractor including materials, parts, or equipment furnished in connection with such work or operations and automobiles owned, leased, hired, or borrowed by or on behalf of the Contractor. General liability coverage can be provided in the form of an endorsement to the Contractor's insurance (at least as broad as ISO Form CG 20 10, CG 11 85 or both CG 20 10 and CG 20 37 forms if later revisions used).
- B. For any claims related to the project, the Contractor's insurance coverage shall be primary insurance as respects the City, its officers, officials, employees, and volunteers. Any insurance or self-insurance maintained by the City, its officers, officials, employees, or volunteers shall be excess of the Contractor's insurance and shall not contribute with Contractor's insurance coverage.
- C. Each required insurance policy shall provide that coverage shall not be canceled, except with advance notice to the City. Additionally, Contractor itself shall also provide immediate notice to the City if any required insurance policy is suspended, voided, canceled, reduced in coverage or in limits.

11.2.2 Builder's Risk (Course of Construction) Insurance

- A. Contractor may submit evidence of Builder's Risk insurance in the form of Course of Construction coverage. Such coverage shall **name the City as a loss payee** as its interest may appear.
- B. If the project does not involve new or major reconstruction, at the option of the City, an Installation Floater may be acceptable. For such projects, a Property Installation Floater shall be obtained that provides for the improvement, remodel, modification, alteration, conversion or adjustment to existing buildings, structures, processes, machinery, and equipment. The Property Installation Floater shall provide property damage coverage for any building, structure, machinery, or equipment damaged, impaired, broken, or destroyed during the performance of the work, including during transit, installation, and testing at the City's site.

11.2.3 Claims Made Policies

If any required coverage is allowed to be written on a claims-made coverage form, all of the following apply:

- A. The retroactive date must be shown, and this date must be before the execution date of the contract or the beginning of contract work.
- B. Insurance must be maintained and evidence of insurance must be provided for at least five (5) years after completion of contract work.
- C. If coverage is canceled or non-renewed, and not replaced with another claims-made policy form with a retroactive date prior to the contract effective, or start of work date, the Contractor must purchase extended reporting period coverage for a minimum of five (5) years after completion of contract work.
- D. A copy of the claims reporting requirements must be submitted to the City for review and approval.
- E. If the services involve lead-based paint or asbestos identification/remediation, the Contractors Pollution Liability policy shall not contain lead-based paint or asbestos exclusions. If the services involve mold identification/remediation, the Contractors Pollution Liability policy shall not contain a mold exclusion, and the definition of Pollution shall include microbial matter, including mold.

11.2.4 Acceptability of Insurers: Insurance shall be placed with insurers with a current A.M. Best rating of no less than A: VII, unless otherwise acceptable to the City. All insurance shall be provided through companies authorized to do business in the state of Ohio.

11.2.5 Waiver of Subrogation: Contractor shall waive rights of subrogation which any insurer of Contractor may acquire from Contractor by virtue of the payment of any loss. Contractor shall obtain any endorsement that may be necessary to affect this waiver of subrogation.

11.2.6 Verification of Coverage:

- A. Contractor shall furnish the City with original certificates and amendatory endorsements, or copies of the applicable insurance language, affecting required coverage. All certificates and endorsements must be received and approved by the City before work commences. However, failure to obtain the required documents prior to the work beginning shall not waive the Contractor's obligation to provide them. The City reserves the right to require complete, certified copies of all required insurance policies, including endorsements, required by these specifications, at any time.
- B. Failure of the City to demand such certificate or other evidence of full compliance with these insurance requirements or failure of the City to identify a deficiency from evidence provided will not be construed as a waiver of the Contractor's obligation to maintain such insurance.
- C. The acceptance of delivery by the City of any certificate of insurance evidencing the required coverages and limits does not constitute approval or agreement by the City that the insurance requirements have been met or that the insurance policies shown in the certificates of insurance are in compliance with the requirements.
- D. The City may prohibit the Contractor or any subcontractor from entering the project site until such certificates or other evidence that insurance has been placed in complete compliance with these requirements is received and approved by the City.
- E. If the Contractor fails to maintain the required insurance, the City may purchase the required insurance and set off the related expense against any amount owed to Contractor. Alternatively, the Contractor's failure to maintain the required insurance may result in termination of the contract, in the City's sole discretion.
- F. If any of the insurance is required to remain in force after final payment, an additional certificate evidencing continuation of such coverage will be submitted with the Contractor's final invoice.

11.2.7 Subcontractors: Contractor shall require and verify that all subcontractors maintain insurance meeting all the requirements stated herein, and Contractor shall ensure that City is an additional insured on insurance required from subcontractors. For CGL coverage, subcontractors shall provide coverage with a format at least as broad as CG 20 38 04 13.

11.3 Special Risks or Circumstances: City reserves the right to modify any of the insurance requirements, including limits, based on the nature of the risk, prior experience, insurer, coverage, or other circumstances.

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 Owner's request or to requirements specifically expressed in the Contract Documents, it must, if required in writing by the Owner, be uncovered for the Owner's observation 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 which the Owner has not specifically requested to observe prior to its being covered, the Owner 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 charged to the Owner. If such Work is not in accordance with the Contract Documents, the Contractor shall pay such costs.

12.2 CORRECTION OF WORK

- 12.2.1 The Contractor shall promptly correct Work rejected by the Owner or Work failing to conform to the requirements of the Contract Documents, whether observed before or after Substantial Completion and whether or not fabricated, installed or completed. The Contractor shall bear costs of correcting such Work, including additional testing and inspections and compensation for the Owner's services and expenses made necessary thereby.
- 12.2.2 If, within one (1) year after the date of substantial completion of the Work, or after the date for commencement of warranties 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. This period of one (1) year 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 performance of those portions of the Work. This obligation under this Subparagraph 12.2.2 shall survive acceptance of the Work under the Contract and termination of the Contract. The Owner shall give such notice within ninety (90) days after discovery of the condition.
- 12.2.3 The Contractor shall remove from the site portions of the Work which 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 If the Contractor fails to correct nonconforming Work within 15 (fifteen) days after being requested to do so, the Owner may correct it in accordance with Paragraph 2.2. If the Contractor does not proceed with correction of such nonconforming Work within a reasonable time fixed by written notice from the Owner, the Owner may remove it and store the salvable materials or equipment at the Contractor's expense. If the Contractor does not pay costs of such removal and storage within ten

(10) days after written notice, the Owner may immediately sell such materials and equipment at auction or at private sale and shall account for the proceeds thereof, after deducting costs and damages that should have been borne by the Contractor, including compensation for the Owner's time and expenses, direct and indirect, made necessary thereby. If such proceeds of sale do not cover costs which the Contractor should have borne, the Contract Sum shall be reduced by the deficiency. If payments then or thereafter due the Contractor are not sufficient to cover such amount, the Contractor shall pay the difference to the Owner.

12.2.5 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 which is not in accordance with the requirements of the Contract Documents.

12.2.6 Nothing contained in this Paragraph 12.2 shall be construed to establish a period of limitation with respect to other obligations which the Contractor might have under the Contract Documents. Establishment of the time period of one (1) year as described in Subparagraph 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, and thus to pay for damage or loss caused by failure to comply and to pay for correcting that failure, 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 which 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. Any such decision by the Owner must be in writing and must specifically identify the Work which fails to meet requirements. Such adjustment shall be effected whether or not final payment has been made.

13. **MISCELLANEOUS PROVISIONS**

13.1 **GOVERNING LAW**

The Invitation To Bid and the Contract and any modifications, amendments, or alterations shall be governed, construed, and enforced under the ordinances of the City of Kettering and the laws of Ohio, without giving effect to conflict of law provisions which would result in the application of any law other than Ohio law. The Contract shall be and hereby is deemed by the parties to be executed in Kettering, Ohio. All litigation arising out of the Invitation to Bid and/or the Contract Documents shall be brought and prosecuted in a court of competent jurisdiction located in Montgomery County, Ohio.

13.2 **SUCCESSORS AND ASSIGNS**

The Owner and Contractor respectively bind themselves, their partners, successors, the assigns of the Owner, such assigns of the Contractor as may be consented to in advance and in writing by the Owner (the Contractor not having power to assign all or part of this Contract without such prior written consent) and their legal representatives to the other party hereto and to partners, successors, permitted assigns and legal representatives of such other party in respect to covenants, agreements and obligations contained in the Contract Documents.

13.3 **WRITTEN NOTICE**

Written notice shall be deemed to have been duly served if delivered in person to the Owner at the office of the City Manager of the Owner or to the Contractor by delivery in person to the individual (if the Contractor is an individual and not an organization) or to a member of the firm or entity or to an officer of the corporation for which it was intended. Such notice shall also be deemed to have been duly served if delivered by FAX or hand delivery (or two (2) business days after being sent by registered or certified mail) to the last fax number or business address of the Contractor known to the Owner or the Owner through the office of the City Manager of the Owner.

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 shall constitute a waiver of a right or duty afforded the Owner under the Contract, nor shall such action or failure to act constitute approval of or acquiescence in a breach thereunder, 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 required by the Contract Documents or by laws, ordinances, rules, regulations or orders of the Owner or other public authorities having jurisdiction shall be made at an appropriate time. 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 (which may be the Owner itself), and Contractor shall bear all related costs of tests, inspections and approvals. The Contractor shall give the Owner timely notice of when and where tests and inspections are to be made so the Owner may observe such procedures. Contractor, at Contractor's sole expense, shall immediately provide the Owner with a copy of all test results after the test results are available

- 13.5.2 If the Owner or other public authorities having jurisdiction determine that portions of the Work require additional testing, inspection or approval not included under Subparagraph 13.5.1, the Owner will 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 Owner of when and where tests and inspections are to be made so the Owner may observe such procedures. The Contractor shall bear such costs.
- 13.5.3 If such procedures for testing, inspection or approval under Subparagraphs 13.5.1 and 13.5.2 reveal failure of the portions of the Work to comply with requirement established by the Contract Documents, the Contractor shall bear all costs made necessary by such failure, including those of repeated procedures and compensation for the Owner's services and expenses.
- 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 Owner.
- 13.5.5 If the Owner is to observe tests, inspections or approvals required by the Contract Documents, the Owner 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 **EQUAL OPPORTUNITY**

The Contractor shall not discriminate against any employee or applicant for employment because of race, color, religious creed, ancestry, physical handicap, sex or political affiliation, and shall take affirmative action to ensure that applicants are employed and that employees are treated during employment without regard to race, color, religious creed, physical handicap, ancestry, sex or political affiliation.

14. **TERMINATION OR SUSPENSION OF THE CONTRACT**

14.1 **TERMINATION BY THE CONTRACTOR FOR CAUSE**

14.1.1 The Contractor may terminate the Contract if the Work is stopped for a period of thirty (30) continuous 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, for any of the following causes:

- 14.1.1.1 issuance of an order of a court or other public authority having jurisdiction based on some act or failure of the Owner;
- 14.1.1.2 an act of government, such as a declaration of national emergency, making material unavailable (not merely difficult, more expensive or slower to obtain);

14.1.1.3 because the Owner has not issued a Certificate for Payment and has not notified the Contractor of the reason for withholding certification or because the Owner has not made payment on a Certificate for Payment within the time stated in the Contract Documents.

14.1.2 If one of the above reasons exists, the Contractor may, upon thirty (30) additional days' written notice to the Owner and if such cause is not corrected or cured within that time, terminate the Contract and recover from the Owner payment for Work executed to the date of termination.

14.2 **TERMINATION BY THE OWNER FOR CAUSE**

14.2.1 The Owner may terminate the Contract if the Contractor:

14.2.1.1 refuses or fails to supply enough properly skilled workers or proper materials in a timely manner;

14.2.1.2 fails to make payment to any Subcontractor or supplier for materials or labor in accordance with the agreement between the Contractor and the Subcontractor or supplier;

14.2.1.3 refuses or fails to comply with any laws, ordinances, or rules, regulations or orders of any government or government agency or authority having jurisdiction; or

14.2.1.4 becomes financially unable to meet its current obligations, or becomes bankrupt, or makes a general assignment for the benefit of its creditors, or has a receiver appointed for it or to take charge of its affairs, or has its property levied upon or taken in execution of any judgment or attachment; or

14.2.1.5 has unnecessarily or unreasonably delayed in performance of the Work so as to fall behind any schedule for completion set between the parties; or

14.2.1.6 although not in violation of any schedule of completion agreed upon between the parties, is progressing so slowly with the Work that it is unreasonable to believe that the Contractor will be able to complete the Work within the Contract Time.

14.2.1.7 otherwise is guilty of breach of a provision of the Contract Documents which the Owner deems to be a substantial matter.

14.2.2 When any of the above reasons exist, the Owner may, without prejudice to any other rights or remedies of the Owner and after giving the Contractor and the Contractor's surety, if any, seven days' written notice, terminate employment of the Contractor and may, subject to any prior rights of the surety:

- 14.2.2.1 take possession of the site and of all materials, equipment, tools, and construction equipment and machinery thereon owned by the Contractor;
 - 14.2.2.2 accept assignment of subcontracts; and
 - 14.2.2.3 finish the Work by whatever reasonable method the Owner may deem expedient.
- 14.2.3 When the Owner terminates the Contract for one of the reasons stated in Subparagraph 14.2.1, the Contractor shall not be entitled to receive further payment.

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 An adjustment shall be made for increases in the cost of performance of the Contract, including profit on the increased cost of performance, caused by suspension, delay or interruption. No adjustment shall be made to the extent:
- 14.3.2.1 that performance is, was or would have been so suspended, delayed or interrupted by another cause for which the Contractor is responsible; or
 - 14.3.2.2 that an equitable adjustment is made or denied under another provision of this Contract.

14.4 TERMINATION FOR NON-APPROPRIATION OF FUNDS

The City, by written advance notice, may terminate this Contract in whole or in part in the event that sufficient appropriation of funds from any source (whether a Federal, State, City or other source) are not made or sufficient funds are otherwise unavailable, in either case, to pay the charges under this Contract. If this Contract is so terminated, the Contractor shall be compensated for all necessary and reasonable direct costs of performing the work actually provided to the date of such termination. The Contractor will not be compensated for any other costs in connection with a termination for non-appropriation. Contractor will not be entitled to recover any damages in connection with a termination for non-appropriation, including, but not limited to, lost profits.

15. **As-Built and Record Documents**

15.1 Upon Final Completion of the Work, the Contractor shall organize the As-Built Documents into manageable sets, bind the sets with durable paper cover sheets, and deliver the As-Built Documents to the Owner. By submitting the As-Built Documents to the Owner, the Contractor certifies that the As-Built Documents are complete, correct, and accurate.

15.2 The Owner may thereafter use the As-Built Documents for any purpose relating to the Project including, but not limited to, additions to or completion of the Project.

End of General Conditions

**CITY OF KETTERING
SUPPLEMENTAL CONDITIONS**

1. GENERAL

- 1.1 The specifications are minimum requirements.
- 1.2 The omission of any standard feature description shall not alleviate the bidder from the responsibility of providing complete work.
- 1.3 The silence of these specifications as to any details or the omission from them of a detailed description concerning any point shall be regarded as meaning that only quality material and correct type, size and design are to be used. All interpretations of this specification shall be made upon the basis of this statement.
- 1.4 All workmanship is to be of first quality.
- 1.5 Bidders are hereby advised that materials purchased for this Contract are exempt from sales tax under Ohio Revised Code Section 5739.02 and material prices quoted in this bid should reflect said exemption.
- 1.6 Prospective bidders are advised that the City does not guarantee the location of any subsurface structures. The locations of the underground utilities shown on any plans are as obtained from the owners of the utility as required by Section 153.64 O.R.C.
- 1.7 Prospective bidders are advised supplemental conditions shall take precedence.
- 1.8 Bidding documents will be issued directly to sub-bidders.
- 1.9 The City's Owner's Representative will be the point of contact for submittals and change orders.

2. DEVIATION CLAUSE

- 2.1 References in these specifications or descriptions of the materials, supplies or services required to a particular trade name, manufacturer's catalog or model number, are made for descriptive purposes to guide the bidder in interpreting the type of materials or supplies or nature of work desired.
- 2.2 They should not be construed as excluding proposals on other types of materials and supplies or for performing the work in a manner other than specified.
- 2.3 However, the Bidder's attention is called to the condition that if awarded a contract, a Bidder will be required to furnish the particular item referred to in strict accordance with the specifications or descriptions as bid, unless departure or substitution is clearly noted and described in the proposal by line item number.

3. LIABILITY OF CONTRACTOR FOR PATENTS, INJURIES, ETC.

- 3.1 The Contractor shall take all responsibility for the work, and take all precautions for preventing injuries to persons and property on or about the work, shall bear all losses resulting to Contractor on account of the amount or character of the work, or because the nature of the ground on which the work is done is different from what was estimated or expected, or on account of the weather, floods, elements, or other causes, and he shall assume the defense of, and indemnify and save harmless, the City and its individual officers and agents, from all claims and judgments relating to: labor, equipment and materials furnished for the work; to inventions, patents and patent rights used in doing the work; to injuries to any person or corporations caused by, incident to, connected with, resulting or arising from the Contractor, subcontractor, and their employees in doing the work, or in consequence of any improper materials, methods, implements or labor used therein; and to any act, omission or neglect of the Contractor, subcontractor, and their employees therein.
- 3.2 If the Contractor shall claim compensation for any damages sustained by reason of the acts of the City, the Contractor shall, within five (5) days after the sustaining of such damage, make a detailed written claim to the City of the nature of the damage sustained. On or before the fifteenth (15th) day of the month succeeding that in which any such damage shall have been sustained, the Contractor, shall file with the City an itemized statement of the details and amount of such damage, and unless such statement shall be made as thus required, his claim for compensation may be forfeited and invalidated, and he shall not be entitled to any payment on account of such damage. The Contractor will also protect the public by such barricades, detour and/or other signs, lights or watchmen as may be necessary, and will guard and keep safe the City from all claims and judgments for damages arising from such neglect.
- 3.3 The mention of any specific duty or liability of the Contractor in any one section of the specifications shall not be construed as a limitation or restriction upon any general liability or duty imposed upon the Contractor by the specifications as a whole, said reference to any specific duty or liability being merely for purposes of explanation.

4. EQUAL OPPORTUNITY

The Contractor shall not discriminate against any employee or applicant for employment because of race, color, religious creed, ancestry, physical handicap, sex or political affiliation, and the Contractor shall take affirmative action to ensure that applicants are employed and that employees are treated during employment without regard to race, color, religious creed, physical handicap, ancestry, sex or political affiliation.

5. WORK EMBRACED

The Contractor shall do all the work and furnish all the materials and equipment, except as otherwise provided herein, necessary or proper for performing and completing the work specified, but in no case will any work in excess of such requirements be paid for unless ordered in writing by the City. The methods and appliances used therefore must be such as will produce a satisfactory quality of work and ensure safety to the public and to property.

6. DECISIONS

All work under this Contract shall be done to the satisfaction of the City which shall in all cases determine the amount, quality, acceptability and fitness of the several kinds of work and material which are to be paid for hereunder, and shall decide all questions which may arise as to the fulfillment of this Contract on the part of the Contractor and the City's determination and decision there on shall be final and conclusive; and such determination and decision, in case any question shall arise, shall be a condition precedent to the right of the Contractor to receive any moneys hereunder.

7. ORDERS TO CONTRACTOR

7.1 The address given in the bid or proposal upon which this Contract is founded is hereby designated as the place where all notices, letters and other communications to the Contractor shall be mailed or delivered.

7.2 The delivering at the above named place or depositing in a postpaid wrapper directed to the above place in any post office box regularly maintained by the post office, of any notice, letter or other communication to the Contractor shall be deemed sufficient service thereof upon the Contractor, and the date of said service shall be the date of such delivery or mailing.

7.3 Such address may be changed at any time by an instrument in writing executed and acknowledged by the Contractor and delivered to the City.

7.4 Nothing contained herein shall be deemed to preclude or render inoperative the service of any notice, letter or other communication upon the Contractor personally.

7.5 The Contractor shall at all times have a foreman, superintendent, or other competent representative present on the job, to whom orders and instructions may be given.

7.6 Such orders shall have the same force and effect as if given directly to the Contractor.

8. LINES AND GRADES

8.1 All work to be done under this agreement must be in accordance with the lines, grades and instructions as given by the City.

8.2 The Contractor will be required to furnish such materials and give such assistance as may be required and shall notify the City forty-eight (48) hours in advance of any need for its service in staking out work.

8.3 The Contractor will be held responsible for the preservation of all stakes and marks, and if any have been carelessly or willfully destroyed or disturbed by the Contractor, the cost of replacing them will be charged against him and deducted from the final payment.

9. LAWS AND REGULATIONS

- 9.1 The Contractor shall keep himself fully informed of all federal or state laws, municipal ordinances, and regulations in any manner affecting those engaged or employed in the work or the materials used in the work, or in any way affecting the contract of the work and of all orders and decrees of bodies or tribunals having any jurisdiction or authority over the same.
- 9.2 The Contractor shall also observe and comply with, and shall cause all Contractor's agents, employees and subcontractors to observe and comply with all such existing and future laws, ordinances, regulations, orders, and decrees, and to protect and to indemnify the City against any claim or liability arising from or based on the violation of such laws, ordinances, regulations, orders or decrees by Contractor , agents, employees or subcontractors.
- 9.3 The Contractor shall comply with all the safety requirements of the Industrial Commission of Ohio Relating to Construction, which requirements are by reference made a part of these specifications.

10. RIGHTS OF WAY

The City will be responsible for the securing of all necessary rights of way. Any exceptions will be indicated in the contract. Wherever it is required as a part of the contract to perform work within the limits of private property, or in public or private rights of way, such work shall be done in conformity with all agreements between the City and such owners, and whether or not such a condition be part of the agreement, care shall be taken to avoid injury to the premises entered. All such premises shall be left in neat and orderly condition.

11. STARTING WORK

- 11.1 Within five (5) days of the date of notification to start, the Contractor shall begin the construction and from said starting date contract time will be charged.
- 11.2 The work will be commenced at such points as the City may direct.
- 11.3 Whenever, in the opinion of the City, it is necessary that certain portions of the work be done immediately, the Contractor shall proceed with such work without delay.
- 11.4 If the work done under this Contract conflicts with other work done for or by the City, or with its consent, the City shall determine the time and manner or procedure of the operations carried on under this Contract.

12. FIRM PRICES

- 12.1 The bid prices shall remain firm for sixty (60) days after the bid opening date.
- 12.2 Prices quoted shall be F.O.B. Kettering, Ohio.

- 12.3 The City shall pay, and the Contractor shall receive, the prices herein stipulated as full compensation for everything furnished and done by the Contractor under this Contract, including all incidental work required but not specifically mentioned; also for all loss or damage arising out of the nature of the work or from action of the weather, floods, or from any unforeseen obstruction or difficulty encountered in the prosecution of the work for all risks of every description connected with the work; for all expense incurred by or in consequence of the suspension or discontinuance of the work as herein provided, together with the remedying of all defects developing during the period for which the work is guaranteed.
13. DISCLOSURE OF PERSONAL PROPERTY TAXES
An affidavit complying with Form C, attached, must be completed by the Contractor after award and prior to entering into a contract in compliance with Section 5719.042 of the Ohio Revised Code.
14. PAYROLL RECORDS (PREVAILING WAGE COMPLIANCE)
- 14.1 By signing a Contract, the Contractor certifies that its Bid is based upon the prevailing rates of wages as ascertained by the Ohio Department of Commerce, Wage and Hour Bureau as provided in Ohio Revised Code ("O.R.C.") Sections 4115.03 through 4115.14.
- 14.2 The Contractor shall pay the prevailing wage rates of the project locality, as determined by the Ohio Department of Commerce, Wage and Hour Bureau, to laborers and mechanics performing work on the project. The prevailing wage rates are available at the Ohio Department of Commerce's web site (<http://www.com.state.oh.us>) and are also attached to this document. The Contractor and its subcontractors shall pay any revised wage rates issued by the Ohio Department of Commerce, Wage and Hour Bureau during the term of the Contract.
- 14.3 The Contractor and its subcontractors shall fully comply with the provisions, duties, obligations, and is subject to the remedies and penalties of O.R.C. Chapter 4115. If the Contractor or its subcontractors fail to comply with O.R.C. Chapter 4115, the City may withhold payment. The Contractor is liable for violations committed by the Contractor or its subcontractors.
- 14.4 The Contractor and its subcontractors shall submit all payroll reports in compliance with the requirements of Chapter 4115 for all of the employees of the Contractor and of the Contractor's subcontractors.
- 14.5 If this is a Federally Funded Project, the Contractor and all subcontractors shall comply with all applicable Federal Labor Laws, Rules, and Regulations ("Federal Labor Standards").
- 14.6 Contractor shall indemnify, defend, and hold the City and the City's elected officials, officers, employees, and volunteers harmless from all claims, costs, and causes of action, including, but not limited to attorneys' fees, which flow from or relate to Contractor's or any of Contractor's subcontractors failure to fully and or timely comply with any applicable requirement under the Federal Labor Standards and/or Ohio Revised Code Chapter 4115 and any related law, rule, or regulation.

15. AWARD

15.1 In making an award, the City will evaluate the bids received, considering such features as listed below, as well as other factors which may be considered pertinent:

15.1.1 Whether Contractor appears on the debarred contractor list.

15.1.2 Compliance with these specification.

15.1.3 The City's own past experience as well as the contractor's experience.

15.1.4 Contractor's knowledge of the work being bid.

15.1.5 Any additional services or qualities offered that will benefit the City.

15.1.6 Locality of the contractor.

15.1.7 Total bid and time for completion of the project.

15.2 The City reserves the right to make awards to more than one bidder and to accept a part or parts of a bid.

15.3 The City reserves the right to accept or reject any or all bids; to waive informalities, irregularities, or defects in bids; to seek new bids; or to accept such bid(s) as the City shall solely deem to be in its best interest; and to award to the contractor most advantageous to the City.

15.4 Failure to have performed satisfactorily any contract previously awarded to the bidder by the City may be sufficient cause for rejection of their bid.

15.5 Upon request, bidders must furnish satisfactory evidence of their ability to do the class of work required and have the necessary equipment available to do the work. Bidders may be required to state what work of a character similar to that included in the proposed contract he had done, to give references and such other detailed information as will enable the City to judge his responsibility, experience, skill and financial standing.

16. INDEMNIFICATION

The Contractor shall defend, indemnify, and hold the City of Kettering and its elected officials, officers, employees, agents, representatives, and volunteers harmless from any claim, cause of action, loss, damage, lawsuit, including attorneys' fees, that result from, whether directly or indirectly, any intentional or negligent act(s) or omission(s) or failure to comply by the Contractor or Contractor's officials, agents, representatives, contractors, subcontractor's, or employees.

17. CHOICE OF LAW

The contract shall be governed by the laws of the State of Ohio, except to the extent that federal law preempts those laws, without giving effect to conflict of law provisions which would result in the application of any law other than Ohio law. Contractor consents to the exclusive jurisdiction of the state and federal courts located in Montgomery County, Ohio, waives any objection thereto, and agrees that any dispute arising under or related to this contract shall be brought therein.

18. INQUIRIES

- 18.1 All inquiries concerning the **General Specifications and Attachments** must be submitted in writing via email to:

Estelle Gibson, Purchasing Manager
City of Kettering
estelle.gibson@ketteringoh.org

- 18.2 All inquiries concerning the **Technical Specifications and Drawings** (bound separately) must be submitted in writing via email to:

Will Kaly, AIA
LWC Incorporated
WKaly@lwcinspires.com

- 18.3 Written questions will be answered as soon as possible.

- 18.4 Written questions developing information which, in the opinion of the City, should be made available to all bidders, will be distributed in question and answer form to all those parties on the bidders list.

ATTACHMENT A

Prevailing Wage Rates



- ▶ [forms](#)
- ▶ [contacts](#)
- ▶ [about LAWS](#)
- ▶ [search](#)

Ohio Department of Commerce Bureau of Wage & Hour Administration

[Consumers](#)
 [Business](#)
 [License/Permit Holders & Applicants](#)
 [Other Government Agencies](#)

[Back to wage rate search](#) [Back to Home](#)

Classification = All, County = MONTGOMERY, Union = All

County	Classification	Effective	Posted	Union
MONTGOMERY	Asbestos Worker	8/23/2018	8/23/2018	Asbestos Local 207 OH
MONTGOMERY	Asbestos Worker	3/10/2021	3/10/2021	Asbestos Local 50 Zone 2
MONTGOMERY	Boilermaker	10/1/2013	9/25/2013	Boilermaker Local 105
MONTGOMERY	Bricklayer	9/2/2020	9/2/2020	Bricklayer Local 22
MONTGOMERY	Bricklayer	7/1/2020	6/25/2020	Bricklayer Local 22 Tile Finisher
MONTGOMERY	Bricklayer	7/1/2020	6/25/2020	Bricklayer Local 22 Tile Mechanics
MONTGOMERY	Carpenter	9/10/2020	9/10/2020	Carpenter Floorlayer SW District G
MONTGOMERY	Carpenter	9/10/2020	9/10/2020	Carpenter Millwright Local 1090 SW Zone II
MONTGOMERY	Carpenter	3/5/2014	3/5/2014	Carpenter NE District Industrial Dock & Door
MONTGOMERY	Carpenter	6/18/2020	6/18/2020	Carpenter & Pile Driver SW Zone 1
MONTGOMERY	Carpenter	5/7/2020	5/7/2020	Carpenter & Pile Driver SW District HevHwy
MONTGOMERY	Bricklayer	6/1/2020	5/21/2020	Cement Mason Bricklayer Local 97 HevHwy A
MONTGOMERY	Bricklayer	6/1/2020	5/21/2020	Cement Mason Bricklayer Local 97 HevHwy B
MONTGOMERY	Cement	6/5/2019	6/5/2019	Cement Mason Local 132 (Dayton)
MONTGOMERY	Cement Mason	5/1/2021	4/23/2021	Cement Mason Statewide HevHwy Exhibit A District III
MONTGOMERY	Cement Mason	5/1/2021	4/23/2021	Cement Mason Statewide HevHwy Exhibit B District III
MONTGOMERY	Lineman	3/16/2021	3/16/2021	Electrical Local 71 DOT Traffic Signal Highway Lighting American Line Builders
MONTGOMERY	Lineman	3/16/2021	3/16/2021	Electrical Local 71 High Tension Pipe Type Cable
MONTGOMERY	Lineman	3/16/2021	3/16/2021	Electrical Local 71 Outside Utility Power
MONTGOMERY	Voice Data Video	10/18/2017	10/18/2017	Electrical Local 71 Voice Data Video Outside
MONTGOMERY	Electrical	11/30/2020	11/18/2020	Electrical Local 82 Inside
MONTGOMERY	Electrical	1/1/2021	12/24/2020	Electrical Local 82 Inside Lt Commercial South West
MONTGOMERY	Electrical	11/30/2020	11/25/2020	Electrical Local 82 Lightning Rod
MONTGOMERY	Voice Data Video	11/30/2020	11/18/2020	Electrical Local 82 Voice Data Video
MONTGOMERY	Elevator	1/5/2021	1/5/2021	Elevator Local 11
MONTGOMERY	Glazier	11/1/2020	10/28/2020	Glazier Local 387
MONTGOMERY	Ironworker	1/27/2021	1/27/2021	Ironworker Local 290
MONTGOMERY	Laborer Group 1	5/1/2021	4/21/2021	Labor HevHwy 3
MONTGOMERY	Laborer	7/3/2019	7/3/2019	Labor Local 1410 Building
MONTGOMERY	Operating Engineer	5/14/2020	5/14/2020	Operating Engineers - Building Local 18 - Zone III
MONTGOMERY	Operating Engineer	5/14/2020	5/14/2020	Operating Engineers - HevHwy Zone II
MONTGOMERY	Drywall Finisher	11/25/2020	11/25/2020	Painter Local 249
MONTGOMERY	Painter	11/25/2020	11/25/2020	Painter Local 249
MONTGOMERY	Painter	11/25/2020	11/25/2020	Painter Local 249 HevHwy
MONTGOMERY	Painter	6/10/2015	6/10/2015	Painter Local 639
MONTGOMERY	Painter	8/3/2016	8/3/2016	Painter Local 639 Zone 2 Sign
MONTGOMERY	Plaster	7/30/2020	7/30/2020	Plasterer Local 132 (Dayton)
MONTGOMERY	Plumber/Pipefitter	6/18/2020	6/18/2020	Plumber Pipefitter Local 162
MONTGOMERY	Roofer	6/4/2020	6/4/2020	Roofer Local 75
MONTGOMERY	Sheet Metal Worker	6/19/2019	6/19/2019	Sheet Metal Local 24 (Dayton)
MONTGOMERY	Sprinkler Fitter	4/1/2021	3/31/2021	Sprinkler Fitter Local 669
MONTGOMERY	Truck Driver	9/11/2019	9/11/2019	Truck Driver Bldg & HevHwy Class 1 Locals 20,40,92,92b,100,175,284,438,377,637,908,957
MONTGOMERY	Truck Driver	10/16/2019	10/16/2019	Truck Driver Bldg & HevHwy Class 2 Locals 20,40,92,92b,100,175,284,438,377,637,908,957

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Important Notice Prevailing Wage Threshold Levels

Before advertising for bids, contracting, or undertaking construction with its own forces, to construct a public improvement, the Public Authority shall have the Ohio Department of Commerce-Division of Industrial Compliance, Bureau of Wage and Hour Administration determine the prevailing rates of wages for workers employed on the public improvement. The wage determination must be included in the project specifications and printed on the bidding blanks where work is done by contract.

"New" construction threshold for <i>Building Construction</i>:	\$250,000
"Reconstruction, enlargement, alteration, repair, remodeling, renovation, or painting" threshold level for <i>Building Construction</i>:	\$75,000

As of January 1, 2020:

"New" construction that involves <i>roads, streets, alleys, sewers, ditches and other works connected to road or bridge construction</i> threshold level has been adjusted to:	\$93,292
"Reconstruction, enlargement, alteration, repair, remodeling, renovation, or painting" that involves <i>roads, streets, alleys, sewers, ditches and other works connected to road or bridge construction</i> threshold level has been adjusted to:	\$27,950

- A) Thresholds are to be adjusted biennially by the Director of the Ohio Department of Commerce.
- B) Biennial adjustments to threshold levels are made according to the Building Cost for Skilled Labor Index published by McGraw-Hill's Engineering News-Record, but may not increase or decrease more than 3% for any year.

If there are questions concerning this notification, please contact:

Ohio Department of Commerce
 Division of Industrial Compliance
 Bureau of Wage and Hour Administration
 6606 Tussing Road, PO Box 4009
 Reynoldsburg, Ohio 43068-9009
 Phone: 614-644-2239
 Fax: 614-728-8639
www.com.ohio.gov

Prevailing Wage Rate Skilled Crafts

Name of Union: Asbestos Local 207 OH

Change # : LCN01-2018fbLoc207OH

Craft : Asbestos Worker Effective Date : 08/23/2018 Last Posted : 08/23/2018

	BHR	Fringe Benefit Payments						Irrevocable Fund		Total PWR	Overtime Rate
		H&W	Pension	App Tr.	Vac.	Annuity	Other	LECET (*)	MISC (*)		
Classification											
Asbestos Abatement	\$25.50	\$7.25	\$6.45	\$0.65	\$0.00	\$0.00	\$0.07	\$0.00	\$0.00	\$39.92	\$52.67
Trainee	\$16.50	\$7.25	\$1.50	\$0.65	\$0.00	\$0.00	\$0.07	\$0.00	\$0.00	\$25.97	\$34.22

Special Calculation Note :

Ratio :

3 Journeymen to 1 Trainee

Jurisdiction (* denotes special jurisdictional note) :

ADAMS, ASHLAND, ASHTABULA*,
 ATHENS, AUGLAIZE, BROWN, BUTLER*,
 CARROLL, CHAMPAIGN, CLARK,
 CLERMONT, CLINTON, COLUMBIANA,
 COSHOCTON, CRAWFORD, CUYAHOGA,
 DARKE, DELAWARE, FAIRFIELD, FAYETTE,
 FRANKLIN, GEAUGA, GREENE, GUERNSEY,
 HAMILTON, HARDIN, HARRISON,
 HIGHLAND, HOCKING, HOLMES, HURON,
 KNOX, LAKE, LICKING, LOGAN, LORAIN,
 MADISON, MAHONING, MARION, MEDINA,
 MIAMI, MONTGOMERY, MORGAN,
 MORROW, MUSKINGUM, NOBLE, PERRY,
 PICKAWAY, PORTAGE, PREBLE,
 RICHLAND, ROSS, SHELBY, STARK,
 SUMMIT, TRUMBULL, TUSCARAWAS,
 UNION, VINTON, WARREN*, WAYNE

Special Jurisdictional Note : Butler County:(townships of Fairfield, Hanover, Liberty, Milford, Morgan, Oxford, Ripley, Ross, StClair, Union & Wayne.)
 (Lemon & Madison) Warren County: (townships of: Deerfield, Hamilton, Harlan, Salem, Union & Washington). (Clear Creek, Franklin, Mossie, Turtle Creek & Wayney). Ashtabula County: (post offices & townships of Ashtabula, Austinburg, Geneva, Harperfield, Jefferson, Plymouth & Saybrook) (townships of Andover, Cherry Valley, Colbrook, Canneaut, Denmark, Dorset, East Orwell, Hartsgrrove, Kingville, Lenox, Monroe, Morgan, New Lyme, North Kingsville, Orwell, Pierpoint, Richmond Rock Creek, Rome, Sheffield, Trumbull,

Wayne, Williamsfield & Windsor) Erie County:(post offices & townships of Berlin, Berlin Heights, Birmingham, Florence ,Huron, Milan, Shinrock & Vermillion)

Details :

Asbestos & lead paint abatement including, but not limited to the removal or encapsulation of asbestos & lead paint, all work in conjunction with the preparation of the removal of same & all work in conjunction with the clean up after said removal. The removal of all insulation materials, whether they contain asbestos or not, from mechanical systems (pipes, boilers, ducts, flues, breaching, etc.) is recognized as being the exclusive work of the Asbestos Abatement Workers.

On all mechanical systems (pipes, boilers, ducts, flues, breaching, etc.) that are going to be demolished, the removal of all insulating materials whether they contain asbestos or not shall be the exclusive work of the Laborers.

An Abatement Journeyman is anyone who has more than 300 hours in the Asbestos Abatement field.

Prevailing Wage Rate Skilled Crafts

Name of Union: Asbestos Local 50 Zone 2

Change # : LCN01-2021fbLoc50

Craft : Asbestos Worker Effective Date : 03/10/2021 Last Posted : 03/10/2021

	BHR		Fringe Benefit Payments					Irrevocable Fund		Total PWR	Overtime Rate	
			H&W	Pension	App Tr.	Vac.	Annuity	Other	LECET (*)			MISC (*)
Classification												
Asbestos Insulation Mechanic	\$30.84		\$7.70	\$7.60	\$0.44	\$0.00	\$2.50	\$0.15	\$0.00	\$0.00	\$49.23	\$64.65
Firestop Technician	\$30.84		\$7.70	\$7.60	\$0.44	\$0.00	\$2.50	\$0.15	\$0.00	\$0.00	\$49.23	\$64.65
Apprentice	Percent											
1st year	57.38	\$17.70	\$7.46	\$0.00	\$0.40	\$0.00	\$0.00	\$0.15	\$0.00	\$0.00	\$25.71	\$34.55
2nd year	68.68	\$21.18	\$7.46	\$0.95	\$0.40	\$0.00	\$0.00	\$0.15	\$0.00	\$0.00	\$30.14	\$40.73
3rd year	78.98	\$24.36	\$7.46	\$1.90	\$0.40	\$0.00	\$0.30	\$0.15	\$0.00	\$0.00	\$34.57	\$46.75
4th year	90.28	\$27.84	\$7.46	\$1.90	\$0.40	\$0.00	\$0.30	\$0.15	\$0.00	\$0.00	\$38.05	\$51.97

Special Calculation Note : Other is Industry Fund

Ratio :

1 Journeymen to 1 Apprentice
4 Journeymen to 1 Apprentice there after.

Jurisdiction (* denotes special jurisdictional note) :

CHAMPAIGN, CLARK, DARKE, GREENE, MIAMI, MONTGOMERY, PREBLE

Special Jurisdictional Note : In Butler County the following townships are included: (Lemon Twp, Madison Twp) In Warren County the following townships are included: (Clear Creek Twp, Franklin Twp, Massie Twp, Turtle Creek Twp, Wayne Twp)

Details :

Prevailing Wage Rate Skilled Crafts

Name of Union: Boilermaker Local 105

Change # : LCN02-2013fbLoc 105

Craft : Boilermaker Effective Date : 10/01/2013 Last Posted : 09/25/2013

	BHR		Fringe Benefit Payments					Irrevocable Fund		Total PWR	Overtime Rate	
			H&W	Pension	App Tr.	Vac.	Annuity	Other	LECET (*)			MISC (*)
Classification												
Boilermaker	\$35.26		\$7.07	\$13.28	\$0.89	\$0.00	\$3.00	\$0.55	\$0.00	\$0.00	\$60.05	\$77.68
Apprentice	Percent											
1st 6 months	70.03	\$24.69	\$7.07	\$11.30	\$0.89	\$0.00	\$2.10	\$0.55	\$0.00	\$0.00	\$46.60	\$58.95
2nd 6 months	75.02	\$26.45	\$7.07	\$11.30	\$0.89	\$0.00	\$2.25	\$0.55	\$0.00	\$0.00	\$48.51	\$61.74
3rd 6 months	80.00	\$28.21	\$7.07	\$11.30	\$0.89	\$0.00	\$2.40	\$0.55	\$0.00	\$0.00	\$50.42	\$64.52
4th 6 months	85.02	\$29.98	\$7.07	\$11.30	\$0.89	\$0.00	\$2.55	\$0.55	\$0.00	\$0.00	\$52.34	\$67.33
5th 6 months	87.52	\$30.86	\$7.07	\$13.28	\$0.89	\$0.00	\$2.63	\$0.55	\$0.00	\$0.00	\$55.28	\$70.71
6th 6 months	90.03	\$31.74	\$7.07	\$13.28	\$0.89	\$0.00	\$2.70	\$0.55	\$0.00	\$0.00	\$56.23	\$72.11
7th 6 months	92.50	\$32.62	\$7.07	\$13.28	\$0.89	\$0.00	\$2.78	\$0.55	\$0.00	\$0.00	\$57.19	\$73.49
8th 6 months	95.00	\$33.50	\$7.07	\$13.28	\$0.89	\$0.00	\$2.85	\$0.55	\$0.00	\$0.00	\$58.14	\$74.89

Special Calculation Note : Other is Supplemental Health and Welfare

Ratio :

5 Journeymen to 1 Apprentice

Jurisdiction (* denotes special jurisdictional note) :

- ADAMS, ATHENS, BROWN, BUTLER,
- CHAMPAIGN, CLARK, CLERMONT,
- CLINTON, FAIRFIELD, FAYETTE, FRANKLIN,
- GALLIA, GREENE, GUERNSEY, HAMILTON,
- HIGHLAND, HOCKING, JACKSON,
- LAWRENCE, LICKING, MADISON, MEIGS,

MIAMI, MONTGOMERY, MORGAN,
MUSKINGUM, NOBLE, PERRY, PICKAWAY,
PIKE, PREBLE, ROSS, SCIOTO, VINTON,
WARREN

Special Jurisdictional Note :

Details :

Prevailing Wage Rate Skilled Crafts

Name of Union: Bricklayer Local 22

Change # : LCN01-2020fbLoc22

Craft : Bricklayer Effective Date : 09/02/2020 Last Posted : 09/02/2020

	BHR		Fringe Benefit Payments					Irrevocable Fund		Total PWR	Overtime Rate	
			H&W	Pension	App Tr.	Vac.	Annuity	Other	LECET (*)	MISC (*)		
Classification												
Bricklayer Stone Mason Refractory	\$28.07		\$8.55	\$6.17	\$0.54	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$43.33	\$57.37
Pointer/Caulker/Cleaner	\$28.07		\$8.55	\$6.17	\$0.54	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$43.33	\$57.37
Improver Apprentices 25 day probationary period then												
1st 6 months	\$18.25		\$8.55	\$0.00	\$0.52	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$27.32	\$36.45
2nd 6 months	\$21.05		\$8.55	\$0.00	\$0.52	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$30.12	\$40.65
3rd 6 months	\$23.86		\$8.55	\$4.87	\$0.52	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$37.80	\$49.73
4th 6 months	\$26.67		\$8.55	\$4.87	\$0.52	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$40.61	\$53.95
Bricklayer Stone Mason Refractory and PCC Apprentice	Percent											
1st 6 months	60.00	\$16.84	\$8.55	\$0.00	\$0.52	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$25.91	\$34.33
2nd 6 months	65.00	\$18.25	\$8.55	\$0.00	\$0.52	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$27.32	\$36.44
3rd 6 months	70.00	\$19.65	\$8.55	\$4.87	\$0.52	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$33.59	\$43.41
4th 6 months	75.00	\$21.05	\$8.55	\$4.87	\$0.52	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$34.99	\$45.52
5th 6 months	80.00	\$22.46	\$8.55	\$4.87	\$0.52	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$36.40	\$47.62
6th 6 months	85.00	\$23.86	\$8.55	\$4.87	\$0.52	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$37.80	\$49.73
7th 6 months	90.00	\$25.26	\$8.55	\$4.87	\$0.52	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$39.20	\$51.83
8th 6 months	95.00	\$26.67	\$8.55	\$4.87	\$0.52	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$40.61	\$53.94
Mason Trainee-1-90 Days	45.00	\$12.63	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$12.63	\$18.95
91-365 Days	45.00	\$12.63	\$8.55	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$21.18	\$27.50
2nd Year	50.00	\$14.04	\$8.55	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$22.58	\$29.60

Special Calculation Note : Classification title contains "Bricklayer" because contract originates within the Bricklayer Local.

Note that the classification description is clarified after the local union number at the top of

the page.

Apprentice and Apprentice Improver, Health and Welfare after 60 days. Mason Trainees Health and Welfare after 90 days.

Ratio :

Bricklayer Stone Mason Refractory Worker:
1-2 Journeymen to 1 Apprentice
3-4 Journeymen to 2 Apprentice
5-6 Journeymen to 2 Apprentice
7-10 Journeymen to 3 Apprentice

Jurisdiction (* denotes special jurisdictional note) :

CHAMPAIGN, CLARK, CLINTON, DARKE, GREENE, HIGHLAND, LOGAN, MIAMI, MONTGOMERY, PREBLE*, SHELBY

Mason Trainee Ratio:

1 Apprentice permits 1 Mason Trainee
2 Apprentice permits 1 Mason Trainee
3 Apprentice permits 2 Mason Trainee
4 Apprentice permits 2 Mason Trainee

In order to utilize a Pre-Apprentice, you must have 1 registered apprentice in your employ.

Ratio of Improver Apprentices to Journeymen in no case shall their be no more than 1 Improver Apprentice to 6 Journeymen

Special Jurisdictional Note : In Preble County the following townships are included: Jackson, Monroe, Harrison, Twin, Jefferson and Washington

Details :

Apprentice Ratio's covers: Bricklayer, Stone Mason, Refractory worker and Pointer, Cleaner, Caulker.

Prevailing Wage Rate Skilled Crafts

Name of Union: Bricklayer Local 22 Tile Finisher

Change # : LCN01-2020fbLoc22

Craft : Bricklayer Effective Date : 07/01/2020 Last Posted : 06/25/2020

Classification	BHR		Fringe Benefit Payments					Irrevocable Fund		Total PWR	Overtime Rate	
			H&W	Pension	App Tr.	Vac.	Annuity	Other	LECET (*)			MISC (*)
Bricklayer Tile Marble Terrazzo Finisher	\$24.47		\$3.00	\$5.72	\$0.44	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$33.63	\$45.86
Base Machine	\$24.97		\$3.00	\$5.72	\$0.44	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$34.13	\$46.61
Apprentice	Percent											
1st 6 months 0-600 hrs	60.00	\$14.68	\$3.00	\$0.00	\$0.44	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$18.12	\$25.46
2nd 6 months 601-1200 hrs	65.00	\$15.91	\$3.00	\$0.00	\$0.44	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$19.35	\$27.30
3rd 6 months 1201-1800 hrs	70.00	\$17.13	\$3.00	\$5.72	\$0.44	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$26.29	\$34.85
4th 6 months 1801-2400	75.00	\$18.35	\$3.00	\$5.72	\$0.44	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$27.51	\$36.69
5th 6 months 2401-3000 hrs	80.00	\$19.58	\$3.00	\$5.72	\$0.44	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$28.74	\$38.52
6th 6 months 3001-3600 hrs	90.00	\$22.02	\$3.00	\$5.72	\$0.44	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$31.18	\$42.19
TMT Helper- May enter Apprentice Program after 90 day completionr												

First 90 Days	45.00	\$11.01	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$11.01	\$16.52
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Special Calculation Note : Classification title contains "Bricklayer" because contract originates within the Bricklayer Local.

Note that the classification description is clarified after the local union number at the top of the page.

Medical Savings Account: The Medical Savings Account can only be deducted providing employee shows proof voluntary enrollment in the program. Minimum contribution of \$1.00 per hourworked with no maximum.

Ratio :

- 1 Journeyman 1 Apprentice
- 5 Journeyman 1 Apprentice
- 10 Journeyman 2 Apprentice
- 15Journeyman 3 Apprentice
- 20 Journeyman 4 Apprentice
- 25 Journeyman 5 Apprentice
- 8 Employees 1 Helper

Jurisdiction (* denotes special jurisdictional note) :

- AUGLAIZE, CHAMPAIGN, CLARK,
- CLINTON, DARKE, GREENE, HARDIN,
- HIGHLAND, LOGAN, MERCER, MIAMI,
- MONTGOMERY, PREBLE*, SHELBY

Special Jurisdictional Note : In Preble County the following townships are included: (Jackson, Monroe, Harrison, Twin and Washington)

Details :

Tile Layer Finishers shall do mixing of mortars & adhesives, cleaning & grouting of tile, unloading of all trucks, unpacking & handling of all tile & materials such as sand, lime, cement, tile, & all types of tile panels, prefabricated on job site. Marble Setter Finishers shall do all cleaning, waxing & polishing, grouting and pointing.

Prevailing Wage Rate Skilled Crafts

Name of Union: Bricklayer Local 22 Tile Mechanics

Change # : LCN01-2020fbLoc22

Craft : Bricklayer Effective Date : 07/01/2020 Last Posted : 06/25/2020

	BHR		Fringe Benefit Payments					Irrevocable Fund		Total PWR	Overtime Rate	
			H&W	Pension	App Tr.	Vac.	Annuity	Other	LECET (*)			MISC (*)
Classification												
Bricklayer Tile Marble Terrazzo Mechanics	\$27.20		\$7.72	\$5.52	\$0.51	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$40.95	\$54.55
Terrazzo Worker	\$27.20		\$7.72	\$5.52	\$0.51	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$40.95	\$54.55
Apprentice	Percent											
1st 6 Months	50.00	\$13.60	\$7.72	\$0.00	\$0.51	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$21.83	\$28.63
2nd 6 Months	55.00	\$14.96	\$7.72	\$0.00	\$0.51	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$23.19	\$30.67
3rd 6 Months	60.00	\$16.32	\$7.72	\$5.52	\$0.51	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$30.07	\$38.23
4th 6 Months	65.00	\$17.68	\$7.72	\$5.52	\$0.51	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$31.43	\$40.27
5th 6 months	70.00	\$19.04	\$7.72	\$5.52	\$0.51	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$32.79	\$42.31
6th 6 months	75.00	\$20.40	\$7.72	\$5.52	\$0.51	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$34.15	\$44.35
7th 6 months	85.00	\$23.12	\$7.72	\$5.52	\$0.51	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$36.87	\$48.43
8th 6 months	95.00	\$25.84	\$7.72	\$5.52	\$0.51	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$39.59	\$52.51

Special Calculation Note : Classification title contains "Bricklayer" because contract originates within the Bricklayer Local.

Note that the classification description is clarified after the local union number at the top of the page.

Ratio :

- 5 Journeymen to 1 Apprentice
- 10 Journeymen to 2 Apprentice
- 15 Journeymen to 3 Apprentice

Jurisdiction (* denotes special jurisdictional note) :

- CHAMPAIGN, CLARK, CLINTON, DARKE,
- GREENE, HIGHLAND, LOGAN, MIAMI,
- MONTGOMERY, PREBLE*, SHELBY

20 Journeymen to 4 Apprentice
25 Journeymen to 5 Apprentice

Special Jurisdictional Note : In Preble County the following townships are included:
(Jackson, Jefferson, Monroe, Harrison, Twin and Washington)

Details :

** (Tile layers work) the laying, cutting or setting of all tile where used for floors, walls, ceilings, walks, promenade roofs, stair treads, stair risers, facings, hearths, fireplaces & decorative inserts together with any marble plinths, thresholds or window stools used in connection with any tile work. the building, shaping forming construction or repairing of all fireplace work, whether in connection with a mantel hearth facing or not, & the setting & preparing of all material such as cement, plaster, mortar, brickwork, iron work or other materials necessary for the proper, safe construction & completion of such work: except that a mantel made exclusively of brick, marble or stone shall be conceded to be bricklayers, marble setters or stonemasons' work respectively.

** Marble, mosaic, venetian enamel & terrazzo. Cutting and assembling of mosaics. all rolling of terrazzo work.

** Caulking of all expansion, perimeter & angle joints shall be the exclusive work of the tile mechanic.

** Marble masons shall consist of carving, cutting & setting of all marble, slate (including blackboards) stone, albereen, carrara, sanionyx, vitrolite & similar opaque glass, scagliola, what ever thickness or dimension.

Prevailing Wage Rate Skilled Crafts

Name of Union: Carpenter Floorlayer SW District G

Change # : LCR01-2020fbLocSWDayton.

Craft : Carpenter Effective Date : 09/10/2020 Last Posted : 09/10/2020

	BHR		Fringe Benefit Payments					Irrevocable Fund		Total PWR	Overtime Rate	
			H&W	Pension	App Tr.	Vac.	Annuity	Other	LECET (*)			MISC (*)
Classification												
Carpenter Floorlayer	\$26.36		\$7.80	\$6.95	\$0.40	\$0.00	\$1.70	\$0.12	\$0.00	\$0.00	\$43.33	\$56.51
Apprentice	Percent											
1st 3 months	60.00	\$15.82	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$15.82	\$23.72
2nd 3 months	60.00	\$15.82	\$7.80	\$0.00	\$0.40	\$0.00	\$1.70	\$0.12	\$0.00	\$0.00	\$25.84	\$33.74
2nd 6 months	60.00	\$15.82	\$7.80	\$0.00	\$0.40	\$0.00	\$1.70	\$0.12	\$0.00	\$0.00	\$25.84	\$33.74
3rd 6 months	60.00	\$15.82	\$7.80	\$0.00	\$0.40	\$0.00	\$1.70	\$0.12	\$0.00	\$0.00	\$25.84	\$33.74
4th 6 months	65.00	\$17.13	\$7.80	\$0.00	\$0.40	\$0.00	\$1.70	\$0.12	\$0.00	\$0.00	\$27.15	\$35.72
5th 6 months	70.00	\$18.45	\$7.80	\$6.95	\$0.40	\$0.00	\$1.70	\$0.12	\$0.00	\$0.00	\$35.42	\$44.65
6th 6 months	75.00	\$19.77	\$7.80	\$6.95	\$0.40	\$0.00	\$1.70	\$0.12	\$0.00	\$0.00	\$36.74	\$46.63
7th 6 months	80.00	\$21.09	\$7.80	\$6.95	\$0.40	\$0.00	\$1.70	\$0.12	\$0.00	\$0.00	\$38.06	\$48.60
8th 6 months	85.00	\$22.41	\$7.80	\$6.95	\$0.40	\$0.00	\$1.70	\$0.12	\$0.00	\$0.00	\$39.38	\$50.58

Special Calculation Note : Other fs for UBC National Fund and Install

Ratio :

1 Journeymen to 1 Apprentice

Jurisdiction (* denotes special jurisdictional note) :

BROWN, BUTLER, CHAMPAIGN, CLARK, CLERMONT, CLINTON, DARKE, GREENE, HAMILTON, LOGAN, MIAMI, MONTGOMERY, PREBLE, SHELBY, WARREN

Special Jurisdictional Note :

Details :

Scope of work shall include, but not be limited to: receiving,unloading,handling,distribution and installation of all carpeting materials,carpet padding or matting materials and all resilient materials whether for use on walls, floors,counter, sink,table and all preparation work necessary in connection therewith, including sanding work. the installation of nonstructural under-layment and the work of removing, cleaning waxing of any of the above. Carpeting shall include any floor covering composed of either natural or synthetic fibers that are made in breadths to be sewed, fastened or directly glued to floors or over cushioning sound-proofing materials.Resilient Floors shall consist of and include the laying of all special designs of wood,wood block, wood composition, cork, linoleum, asphalt, mastic, plastic,rubber tile,whether nailed or glued.

Prevailing Wage Rate Skilled Crafts

Name of Union: Carpenter Millwright Local 1090 SW Zone II

Change # : LCN01-2020fbLoc1066

Craft : Carpenter Effective Date : 09/10/2020 Last Posted : 09/10/2020

	BHR		Fringe Benefit Payments					Irrevocable Fund		Total PWR	Overtime Rate	
			H&W	Pension	App Tr.	Vac.	Annuity	Other	LECET (*)			MISC (*)
Classification												
Carpenter Millwright	\$31.05		\$7.78	\$6.95	\$0.44	\$0.00	\$6.63	\$0.25	\$0.00	\$0.00	\$53.10	\$68.62
Apprentice	Percent											
1st 6 months	60.00	\$18.63	\$7.78	\$4.27	\$0.44	\$0.00	\$3.98	\$0.25	\$0.00	\$0.00	\$35.35	\$44.67
2nd 6 months	65.00	\$20.18	\$7.78	\$4.61	\$0.44	\$0.00	\$4.31	\$0.25	\$0.00	\$0.00	\$37.57	\$47.66
3rd 6 months	70.00	\$21.73	\$7.78	\$4.94	\$0.44	\$0.00	\$4.64	\$0.25	\$0.00	\$0.00	\$39.78	\$50.65
4th 6 months	75.00	\$23.29	\$7.78	\$5.28	\$0.44	\$0.00	\$4.97	\$0.25	\$0.00	\$0.00	\$42.01	\$53.65
5th 6 months	80.00	\$24.84	\$7.78	\$5.61	\$0.44	\$0.00	\$5.30	\$0.25	\$0.00	\$0.00	\$44.22	\$56.64
6th 6 months	85.00	\$26.39	\$7.78	\$5.95	\$0.44	\$0.00	\$5.64	\$0.25	\$0.00	\$0.00	\$46.45	\$59.65
7th 6 months	90.00	\$27.94	\$7.78	\$6.28	\$0.44	\$0.00	\$5.97	\$0.25	\$0.00	\$0.00	\$48.67	\$62.64
8th 6 months	95.00	\$29.50	\$7.78	\$6.62	\$0.44	\$0.00	\$6.30	\$0.25	\$0.00	\$0.00	\$50.89	\$65.64

Special Calculation Note : Other (\$0.25) \$0.10 Natioanl Fund, \$0.10 for Drug Safety Program and \$0.05 for Natioanl Millwright Fund.

Ratio :

3 Journeymen to 1 Apprentice

Jurisdiction (* denotes special jurisdictional note) :

CHAMPAIGN, CLARK, DARKE, GREENE, LOGAN, MIAMI, MONTGOMERY, PREBLE, SHELBY

Special Jurisdictional Note :

Details :

PAULDING, PERRY, PICKAWAY, PIKE,
PORTAGE, PREBLE, PUTNAM, RICHLAND,
ROSS, SANDUSKY, SCIOTO, SENECA,
SHELBY, STARK, SUMMIT, TRUMBULL,
TUSCARAWAS, UNION, VAN WERT, VINTON,
WARREN, WASHINGTON, WAYNE,
WILLIAMS, WOOD, WYANDOT

Special Jurisdictional Note : Industrial Dock and Door is the installation of overhead doors,
roll up doors and dock leveling equipment

Details :

10/27/10 New Contract jc

Prevailing Wage Rate Skilled Crafts

Name of Union: Carpenter & Pile Driver
SW Zone 1

Change # : LCN01-2020fbLoc126

Craft : Carpenter Effective Date : 06/18/2020 Last Posted : 06/18/2020

	BHR		Fringe Benefit Payments					Irrevocable Fund		Total PWR	Overtime Rate	
			H&W	Pension	App Tr.	Vac.	Annuity	Other	LECET (*)			MISC (*)
Classification												
Carpenter	\$27.87		\$7.81	\$6.95	\$0.38	\$0.00	\$1.64	\$0.17	\$0.00	\$0.00	\$44.82	\$58.76
Pile Driver	\$25.84		\$6.62	\$6.95	\$0.40	\$0.00	\$0.91	\$0.10	\$0.00	\$0.00	\$40.82	\$53.74
Apprentice												
	Percent											
1st 3 Months	60.00	\$16.72	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$16.72	\$25.08
2nd 3 Months	60.00	\$16.72	\$7.81	\$0.00	\$0.38	\$0.00	\$1.64	\$0.17	\$0.00	\$0.00	\$26.72	\$35.08
2nd 6 Months	60.00	\$16.72	\$7.81	\$0.00	\$0.38	\$0.00	\$1.64	\$0.17	\$0.00	\$0.00	\$26.72	\$35.08
3th 6 Months	65.00	\$18.12	\$7.81	\$0.00	\$0.38	\$0.00	\$1.64	\$0.17	\$0.00	\$0.00	\$28.12	\$37.17
4th 6 Months	65.00	\$18.12	\$7.81	\$0.00	\$0.38	\$0.00	\$1.64	\$0.17	\$0.00	\$0.00	\$28.12	\$37.17
5th 6 Months	70.00	\$19.51	\$7.81	\$6.95	\$0.38	\$0.00	\$1.64	\$0.17	\$0.00	\$0.00	\$36.46	\$46.21
6th 6 Months	75.00	\$20.90	\$7.81	\$6.95	\$0.38	\$0.00	\$1.64	\$0.17	\$0.00	\$0.00	\$37.85	\$48.30
7th 6 Months	80.00	\$22.30	\$7.81	\$6.95	\$0.38	\$0.00	\$1.64	\$0.17	\$0.00	\$0.00	\$39.25	\$50.39
8th 6 Months	85.00	\$23.69	\$7.81	\$6.95	\$0.38	\$0.00	\$1.64	\$0.17	\$0.00	\$0.00	\$40.64	\$52.48

Special Calculation Note : Other is for UBC National Fund

Ratio :

- 1 Journeyman to 1 Apprentice
- 3 Journeyman to 1 Apprentice
- 5 Journeyman to 1 Apprentice

Jurisdiction (* denotes special jurisdictional note) :

- CHAMPAIGN, CLARK, DARKE, GREENE,
- LOGAN, MIAMI, MONTGOMERY, PREBLE,
- SHELBY

Special Jurisdictional Note :

Details :

Carpenter duties shall include but not limited to: Pile driving, milling, fashioning, joining, assembling, erecting, fastening, or dismantling of all material of wood, plastic, metal, fiber, cork, and composition, and all other substitute materials: pile driving, cutting, fitting, and placing of lagging, and the handling, cleaning, erecting, installing, and dismantling of machinery, equipment, and erecting pre-engineered metal buildings.

Pile Drivers work but not limited to: unloading, assembling, erection, repairs, operation, signaling, dismantling, and reloading all equipment that is used for pile driving including pile butts. pile butts is defined as sheeting or scrap piling. Underwater work that may be required in connection with the installation of piling. The diver and his tender work as a team and shall arrive at their own financial arrangements with the contractor. Any configuration of wood, steel, concrete, or composite that is jetted, driven, or vibrated onto the ground by conventional pile driving equipment for the purpose of supporting a future load that may be permanent or temporary.

Driving bracing, plumbing, cutting off and capping of all piling whether wood, metal, pipe piling or composite. loading, unloading, erecting, framing, dismantling, moving, and handling of pile driving equipment. piling used in the construction and repair of all wharves, docks, piers, trestles, caissons, cofferdams, and the erection of all sea walls and breakwaters. All underwater and marine work on bulkheads, wharves, docks, shipyards, caissons, piers, bridges, pipeline work, viaducts, marine cable and trestles, as well as salvage and reclamation work where divers are employed.

Rate shall include carpenters, acoustic, and ceiling installers, drywall installers, pile drivers, and floorlayers.

Prevailing Wage Rate Skilled Crafts

Name of Union: Carpenter & Pile Driver SW District HevHwy

Change # : LCN01-2020fbLoc126

Craft : Carpenter Effective Date : 05/07/2019 Last Posted : 05/07/2020

	BHR		Fringe Benefit Payments					Irrevocable Fund		Total PWR	Overtime Rate	
			H&W	Pension	App Tr.	Vac.	Annuity	Other	LECET (*)			MISC (*)
Classification												
Carpenter	\$31.01		\$7.89	\$6.95	\$0.40	\$0.00	\$2.82	\$0.12	\$0.00	\$0.00	\$49.19	\$64.70
Pile Driver	\$29.34		\$6.63	\$6.95	\$0.40	\$0.00	\$1.97	\$0.10	\$0.00	\$0.00	\$45.39	\$60.06
Apprentice	Percent											
1st 6 Months	60.00	\$18.61	\$7.89	\$6.95	\$0.40	\$0.00	\$2.82	\$0.12	\$0.00	\$0.00	\$36.79	\$46.09
2nd 6 Months is 1st year	65.00	\$20.16	\$7.89	\$6.95	\$0.40	\$0.00	\$2.82	\$0.12	\$0.00	\$0.00	\$38.34	\$48.41
3rd 6 Months	70.00	\$21.71	\$7.89	\$6.95	\$0.40	\$0.00	\$2.82	\$0.12	\$0.00	\$0.00	\$39.89	\$50.74
4th 6 Months is 2 years	75.00	\$23.26	\$7.89	\$6.95	\$0.40	\$0.00	\$2.82	\$0.12	\$0.00	\$0.00	\$41.44	\$53.07
5th 6 Months	80.00	\$24.81	\$7.89	\$6.95	\$0.40	\$0.00	\$2.82	\$0.12	\$0.00	\$0.00	\$42.99	\$55.39
6th 6 Months is 3 years	85.00	\$26.36	\$7.89	\$6.95	\$0.40	\$0.00	\$2.82	\$0.12	\$0.00	\$0.00	\$44.54	\$57.72
7th 6 Months	90.00	\$27.91	\$7.89	\$6.95	\$0.40	\$0.00	\$2.82	\$0.12	\$0.00	\$0.00	\$46.09	\$60.04
8th 6 Months is 4 years	95.00	\$29.46	\$7.89	\$6.95	\$0.40	\$0.00	\$2.82	\$0.12	\$0.00	\$0.00	\$47.64	\$62.37

Special Calculation Note : Other is UBC National Fund.

Ratio :

1 Journeymen to 1 Apprentice

An employer shall have the right to employ one (1) Apprentice for one (1) Journeyman Carpenter in its employment for the first Apprentice employed, and 1 (1) Apprentice for two (2)

Jurisdiction (* denotes special jurisdictional note) :

BROWN, BUTLER, CHAMPAIGN, CLARK, CLERMONT, CLINTON, DARKE, GREENE, HAMILTON, LOGAN, MIAMI, MONTGOMERY, PREBLE, SHELBY, WARREN

Journeyman Carpenter for additional Apprentices employed.

Thereafter, every third additional carpenter hired shall be an apprentice, if available, and if practical for the type of work being performed.

Special Jurisdictional Note :

Details :

Highway Construction, Airport Construction, Heavy Construction but not limited to: (tunnels,subways,drainage projects,flood control,reservoirs). Railroad Construction,Sewer Waterworks & Utility Construction but not limited to: (storm sewers, waterlines, gaslines). Industrial & Building Site, Power Plant, Amusement Park, Athletic Stadium Site, Sewer and Water Plants. When the Contractor furnishes the necessary underwater gear for the Diver, the Diver shall be paid one and one half (1&1/2) times the journeyman rate for the time spent in the water.

Prevailing Wage Rate Skilled Crafts

Name of Union: Cement Mason Bricklayer Local 97 HevHwy A

Change # : LCN01-2020fbHvyHwy

Craft : Bricklayer Effective Date : 06/01/2020 Last Posted : 05/21/2020

	BHR		Fringe Benefit Payments					Irrevocable Fund		Total PWR	Overtime Rate	
			H&W	Pension	App Tr.	Vac.	Annuity	Other	LECET (*)			MISC (*)
Classification												
Cement Mason Bricklayer Sewer Water Works A	\$29.96	\$9.50	\$6.77	\$0.47	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$46.70	\$61.68
Apprentice	Percent											
1st year	50.00	\$14.98	\$9.50	\$6.77	\$0.47	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$31.72	\$39.21
2nd year	70.00	\$20.97	\$9.50	\$6.77	\$0.47	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$37.71	\$48.20
3rd year	90.00	\$26.96	\$9.50	\$6.77	\$0.47	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$43.70	\$57.19

Special Calculation Note : NOT FOR BUILDING CONSTRUCTION.

Ratio :

- 3 Journeymen to 1 Apprentice
- 6 Journeymen to 2 Apprentice
- 9 Journeymen to 3 Apprentice
- 12 Journeymen to 4 Apprentice
- 15 Journeymen to 5 Apprentice

Jurisdiction (* denotes special jurisdictional note) :

- ADAMS, ALLEN, ASHLAND, ASHTABULA, ATHENS, AUGLAIZE, BELMONT, BROWN, BUTLER, CARROLL, CHAMPAIGN, CLARK, CLERMONT, CLINTON, COLUMBIANA, COSHOCTON, CRAWFORD, CUYAHOGA, DARKE, DEFIANCE, DELAWARE, ERIE, FAIRFIELD, FAYETTE, FRANKLIN, FULTON, GALLIA, GEauga, GREENE, GUERNSEY, HAMILTON, HANCOCK, HARDIN, HARRISON, HENRY, HIGHLAND, HOCKING, HOLMES, HURON, JACKSON, JEFFERSON, KNOX, LAKE, LAWRENCE, LICKING, LOGAN, LORAIN, LUCAS, MADISON, MAHONING, MARION, MEDINA, MEIGS, MERCER, MIAMI, MONROE, MONTGOMERY, MORGAN, MORROW, MUSKINGUM, NOBLE, OTTAWA, PAULDING, PERRY, PICKAWAY, PIKE, PORTAGE, PREBLE, PUTNAM, RICHLAND,

ROSS, SANDUSKY, SCIOTO, SENECA,
SHELBY, STARK, SUMMIT, TRUMBULL,
TUSCARAWAS, UNION, VAN WERT,
VINTON, WARREN, WASHINGTON, WAYNE

Special Jurisdictional Note :

Details :

(A) Highway Construction, Sewer, Waterworks And Utility Construction, Industrial & Building Site Heavy Construction, Airport Construction Or Railroad Construction Work.

(B) Power Plant, Tunnels, Amusement Park, Athletic Stadium Site Work ,Pollution Control,Sewer Plant, Waste Plant, & Water Treatment Facilities, Construction.

Prevailing Wage Rate Skilled Crafts

Name of Union: Cement Mason Bricklayer Local 97 HevHwy B

Change # : LCN01-2020fbHvyHwy

Craft : Bricklayer Effective Date : 06/01/2020 Last Posted : 05/21/2020

	BHR		Fringe Benefit Payments					Irrevocable Fund		Total PWR	Overtime Rate	
			H&W	Pension	App Tr.	Vac.	Annuity	Other	LECET (*)			MISC (*)
Classification												
Cement Mason Bricklayer Power Plants Tunnels Amusement Parks B	\$30.95		\$9.50	\$6.77	\$0.48	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$47.70	\$63.17
Apprentice	Percent											
1st year	50.00	\$15.48	\$9.50	\$6.77	\$0.48	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$32.23	\$39.96
2nd year	70.00	\$21.66	\$9.50	\$6.77	\$0.48	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$38.42	\$49.25
3rd year	90.00	\$27.85	\$9.50	\$6.77	\$0.48	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$44.60	\$58.53

Special Calculation Note : NOT FOR BUILDING CONSTRUCTION.

Ratio :

- 3 Journeymen to 1 Apprentice
- 6 Journeymen to 2 Apprentice
- 9 Journeymen to 2 Apprentice
- 12 Journeymen to 4 Apprentice
- 15 Journeymen to 5 Apprentice

Jurisdiction (* denotes special jurisdictional note) :

ADAMS, ALLEN, ASHLAND, ASHTABULA, ATHENS, AUGLAIZE, BELMONT, BROWN, BUTLER, CARROLL, CHAMPAIGN, CLARK, CLERMONT, CLINTON, COLUMBIANA, COSHOCTON, CRAWFORD, CUYAHOGA, DARKE, DEFIANCE, DELAWARE, ERIE, FAIRFIELD, FAYETTE, FRANKLIN, FULTON, GALLIA, GEauga, GREENE, GUERNSEY, HAMILTON, HANCOCK, HARDIN, HARRISON, HENRY, HIGHLAND, HOCKING, HOLMES, HURON, JACKSON, JEFFERSON, KNOX, LAKE, LAWRENCE, LICKING, LOGAN, LORAIN, LUCAS, MADISON, MAHONING, MARION, MEDINA, MEIGS, MERCER, MIAMI, MONROE, MONTGOMERY, MORGAN, MORROW, MUSKINGUM, NOBLE, OTTAWA,

PAULDING, PERRY, PICKAWAY, PIKE,
PORTAGE, PREBLE, PUTNAM, RICHLAND,
ROSS, SANDUSKY, SCIOTO, SENECA,
SHELBY, STARK, SUMMIT, TRUMBULL,
TUSCARAWAS, UNION, VAN WERT,
VINTON, WARREN, WASHINGTON, WAYNE

Special Jurisdictional Note :

Details :

(A) Highway Construction, Sewer, Waterworks And Utility Construction, Industrial & Building Site Heavy Construction, Airport Construction Or Railroad Construction Work.

(B) Power Plant, Tunnels, Amusement Park, Athletic Stadium Site Work ,Pollution Control,Sewer Plant, Waste Plant, & Water Treatment Facilities, Construction.

Prevailing Wage Rate Skilled Crafts

Name of Union: Cement Mason Local 132 (Dayton)

Change # : LCN01-2019fbLoc132

Craft : Cement Effective Date : 06/05/2019 Last Posted : 06/05/2019

	BHR		Fringe Benefit Payments						Irrevocable Fund		Total PWR	Overtime Rate
			H&W	Pension	App Tr.	Vac.	Annuity	Other	LECET (*)	MISC (*)		
Classification												
Cement Mason	\$23.93		\$7.50	\$6.65	\$0.70	\$0.00	\$2.25	\$0.00	\$0.00	\$0.00	\$41.03	\$53.00
Apprentice	Percent											
1st yr	70.00	\$16.75	\$7.50	\$6.65	\$0.70	\$0.00	\$2.25	\$0.00	\$0.00	\$0.00	\$33.85	\$42.23
2nd yr	80.00	\$19.14	\$7.50	\$6.65	\$0.70	\$0.00	\$2.25	\$0.00	\$0.00	\$0.00	\$36.24	\$45.82
3rd yr	90.00	\$21.54	\$7.50	\$6.65	\$0.70	\$0.00	\$2.25	\$0.00	\$0.00	\$0.00	\$38.64	\$49.41

Special Calculation Note : No special calculations for this skilled craft wage rate are required at this time.

Ratio :

2 Journeymen to 1 Apprentice

Jurisdiction (* denotes special jurisdictional note) :

CHAMPAIGN, CLARK, CLINTON, DARKE, GREENE, MIAMI, MONTGOMERY, PREBLE, SHELBY

Special Jurisdictional Note :

Details :

Other: Is Industry Promotion: Cement Masons on outrigger, swing, scaffolds, manlifts -\$.75 per hour above scale up to (25) feet and \$.75 per hour for each additional (25) feet or part of same. A Cement Mason operating a grinder- \$.30 per hour above the journeyman scale.

Prevailing Wage Rate Skilled Crafts

Name of Union: Cement Mason Statewide HevHwy Exhibit A District III

Change # : OCN01-2021fbCementHevHwy

Craft : Cement Mason Effective Date : 05/01/2021 Last Posted : 04/23/2021

	BHR		Fringe Benefit Payments					Irrevocable Fund		Total PWR	Overtime Rate	
			H&W	Pension	App Tr.	Vac.	Annuity	Other	LECET (*)	MISC (*)		
Classification												
Cement Mason	\$30.50		\$8.25	\$7.35	\$0.65	\$0.00	\$2.25	\$0.07	\$0.00	\$0.00	\$49.07	\$64.32
Apprentice Percent												
1st Year	70.00	\$21.35	\$8.25	\$7.35	\$0.65	\$0.00	\$2.25	\$0.07	\$0.00	\$0.00	\$39.92	\$50.60
2nd Year	80.00	\$24.40	\$8.25	\$7.35	\$0.65	\$0.00	\$2.25	\$0.07	\$0.00	\$0.00	\$42.97	\$55.17
3rd Year	90.00	\$27.45	\$8.25	\$7.35	\$0.65	\$0.00	\$2.25	\$0.07	\$0.00	\$0.00	\$46.02	\$59.75

Special Calculation Note : Other \$0.07 is for International Training Fund

Ratio :

1 Journeymen to 1 Apprentice
2 to 1 thereafter

Jurisdiction (* denotes special jurisdictional note) :

ADAMS, ASHLAND, ATHENS, BELMONT, CHAMPAIGN, CLARK, CLINTON, COSHOCTON, CRAWFORD, DARKE, DELAWARE, FAIRFIELD, FAYETTE, FRANKLIN, GALLIA, GREENE, GUERNSEY, HARRISON, HOCKING, JACKSON, JEFFERSON, KNOX, LAWRENCE, LICKING, MADISON, MARION, MEIGS, MIAMI, MONROE, MONTGOMERY, MORGAN, MORROW, MUSKINGUM, NOBLE, PERRY, PICKAWAY, PIKE, PREBLE, RICHLAND, ROSS, SCIOTO, SHELBY, UNION, VINTON, WASHINGTON, WYANDOT

Special Jurisdictional Note : (A) Highway Construction, Sewer, Waterworks And Utility Construction, Industrial & Building Site, Heavy Construction, Airport Construction Or Railroad Construction Work.

Details :

Prevailing Wage Rate Skilled Crafts

Name of Union: Cement Mason Statewide HevHwy Exhibit B District III

Change # : OCN01-2021fbCementHevHwy

Craft : Cement Mason Effective Date : 05/01/2021 Last Posted : 04/23/2021

	BHR		Fringe Benefit Payments					Irrevocable Fund		Total PWR	Overtime Rate	
			H&W	Pension	App Tr.	Vac.	Annuity	Other	LECET (*)	MISC (*)		
Classification												
Cement Mason	\$30.66		\$8.25	\$7.35	\$0.65	\$0.00	\$2.25	\$0.07	\$0.00	\$0.00	\$49.23	\$64.56
Apprentice	Percent											
1st Year	70.00	\$21.46	\$8.25	\$7.35	\$0.65	\$0.00	\$2.25	\$0.07	\$0.00	\$0.00	\$40.03	\$50.76
2nd Year	80.00	\$24.53	\$8.25	\$7.35	\$0.65	\$0.00	\$2.25	\$0.07	\$0.00	\$0.00	\$43.10	\$55.36
3rd Year	90.00	\$27.59	\$8.25	\$7.35	\$0.65	\$0.00	\$2.25	\$0.07	\$0.00	\$0.00	\$46.16	\$59.96

Special Calculation Note : Other \$0.07 is for International Training Fund

Ratio :

1 Journeymen to 1 Apprentice
2 to 1 thereafter

Jurisdiction (* denotes special jurisdictional note) :

ADAMS, ASHLAND, ATHENS, BELMONT, CHAMPAIGN, CLARK, CLINTON, COSHOCTON, CRAWFORD, DARKE, DELAWARE, FAIRFIELD, FAYETTE, FRANKLIN, GALLIA, GREENE, GUERNSEY, HARRISON, HOCKING, JACKSON, JEFFERSON, KNOX, LAWRENCE, LICKING, MADISON, MARION, MEIGS, MIAMI, MONROE, MONTGOMERY, MORGAN, MORROW, MUSKINGUM, NOBLE, PERRY, PICKAWAY, PIKE, PREBLE, RICHLAND, ROSS, SCIOTO, SHELBY, UNION, VINTON, WASHINGTON, WYANDOT

Special Jurisdictional Note : (B) Power Plant, Tunnels, Amusement Park, Athletic Stadium Site Work ,Pollution Control,Sewer Plant, Waste Plant, & Water Treatment Facilities, Construction.

Details :

Prevailing Wage Rate Skilled Crafts

Name of Union: Electrical Local 71 DOT Traffic Signal Highway Lighting American Line Builders

Change # : LCRO1-2021fbLoc71DOTClev

Craft : Lineman Effective Date : 03/16/2021 Last Posted : 03/16/2021

	BHR	Fringe Benefit Payments						Irrevocable Fund		Total PWR	Overtime Rate
		H&W	Pension	App Tr.	Vac.	Annuity	Other	LECET (*)	MISC (*)		
Classification											
Electrical Lineman	\$40.31	\$6.75	\$1.21	\$0.40	\$0.00	\$7.66	\$0.06	\$0.00	\$0.00	\$56.39	\$76.54
Traffic Signal & Lighting Journeyman	\$38.77	\$6.75	\$1.16	\$0.39	\$0.00	\$7.37	\$0.06	\$0.00	\$0.00	\$54.50	\$73.89
Equipment Operator	\$35.41	\$6.75	\$1.06	\$0.35	\$0.00	\$6.73	\$0.06	\$0.00	\$0.00	\$50.36	\$68.06
Groundman 0 to 12 months (W/O CDL)	\$21.47	\$6.75	\$0.64	\$0.21	\$0.00	\$4.08	\$0.06	\$0.00	\$0.00	\$33.21	\$43.95
Groundman 0 to 12 Months (W CDL)	\$23.46	\$6.75	\$0.70	\$0.23	\$0.00	\$4.46	\$0.06	\$0.00	\$0.00	\$35.66	\$47.39
Groundman greater than 1 year (W CDL)	\$25.45	\$6.75	\$0.76	\$0.25	\$0.00	\$4.84	\$0.06	\$0.00	\$0.00	\$38.11	\$50.83
Traffic Apprentice											
1st 1000 hrs	\$23.26	\$6.75	\$0.70	\$0.23	\$0.00	\$4.42	\$0.06	\$0.00	\$0.00	\$35.42	\$47.05
2nd 1000 hrs	\$25.20	\$6.75	\$0.76	\$0.25	\$0.00	\$4.79	\$0.06	\$0.00	\$0.00	\$37.81	\$50.41
3rd 1000 hrs	\$27.14	\$6.75	\$0.81	\$0.27	\$0.00	\$5.16	\$0.06	\$0.00	\$0.00	\$40.19	\$53.76
4th 1000 hrs	\$29.08	\$6.75	\$0.87	\$0.29	\$0.00	\$5.53	\$0.06	\$0.00	\$0.00	\$42.58	\$57.12
5th 1000 hrs	\$31.01	\$6.75	\$0.93	\$0.31	\$0.00	\$5.89	\$0.06	\$0.00	\$0.00	\$44.95	\$60.46
6th 1000 hrs	\$34.89	\$6.75	\$1.05	\$0.35	\$0.00	\$6.63	\$0.06	\$0.00	\$0.00	\$49.73	\$67.17
Lineman	Percent										

Apprentice												
1st 1,000 Hours	60.00	\$24.19	\$6.75	\$0.73	\$0.24	\$0.00	\$4.60	\$0.06	\$0.00	\$0.00	\$36.57	\$48.66
2nd 1,000 Hours	65.00	\$26.20	\$6.75	\$0.79	\$0.26	\$0.00	\$4.98	\$0.06	\$0.00	\$0.00	\$39.04	\$52.14
3rd 1,000 Hours	70.00	\$28.22	\$6.75	\$0.85	\$0.28	\$0.00	\$5.36	\$0.06	\$0.00	\$0.00	\$41.52	\$55.63
4th 1,000 Hours	75.00	\$30.23	\$6.75	\$0.91	\$0.30	\$0.00	\$5.74	\$0.06	\$0.00	\$0.00	\$43.99	\$59.11
5th 1,000 Hours	80.00	\$32.25	\$6.75	\$0.97	\$0.32	\$0.00	\$6.13	\$0.06	\$0.00	\$0.00	\$46.48	\$62.60
6th 1,000 Hours	85.00	\$34.26	\$6.75	\$1.03	\$0.34	\$0.00	\$6.51	\$0.06	\$0.00	\$0.00	\$48.95	\$66.09
7th 1,000 Hours	90.00	\$36.28	\$6.75	\$1.09	\$0.36	\$0.00	\$6.89	\$0.06	\$0.00	\$0.00	\$51.43	\$69.57

Special Calculation Note : Other is for Safety and Education Fund

Ratio :

1 Journeymen to 1 Apprentice

Jurisdiction (* denotes special jurisdictional note) :

AUGLAIZE, CHAMPAIGN, CLARK, CLINTON, DARKE, GREENE, LOGAN, MERCER, MIAMI, MONTGOMERY, PREBLE, SHELBY

Special Jurisdictional Note :

Details :

A groundman when directed shall assist a Journeymen in the performance of his/her work on the ground, including the use of hand tools. Under no circumstances shall this classification climb poles, towers, ladders, or work from an elevated platform or bucket truck. This classification shall not perform work normally assigned to an apprentice lineman. No more than three (3) Groundmen shall work alone. Jobs with more that three Groundmen shall be supervised by a Groundcrew Foreman, Journeyman Lineman, Journeyman Traffic Signal Technician or an Equipment Operator.

Prevailing Wage Rate

Skilled Crafts

Name of Union: Electrical Local 71 High Tension Pipe Type Cable

Change # : LCN01-2021fbLoc7

Craft : Lineman Effective Date : 03/16/2021 Last Posted : 03/16/2021

	BHR	Fringe Benefit Payments						Irrevocable Fund		Total PWR	Overtime Rate
		H&W	Pension	App Tr.	Vac.	Annuity	Other	LECET (*)	MISC (*)		
Classification											
Electrical Lineman	\$45.61	\$6.75	\$1.37	\$0.46	\$0.00	\$10.95	\$0.60	\$0.00	\$0.00	\$65.74	\$88.54
Certified Lineman Welder	\$45.61	\$6.75	\$1.37	\$0.46	\$0.00	\$10.95	\$0.60	\$0.00	\$0.00	\$65.74	\$88.54
Certified Cable Splicer	\$45.61	\$6.75	\$1.37	\$0.46	\$0.00	\$10.95	\$0.60	\$0.00	\$0.00	\$65.74	\$88.54
Operator A	\$40.88	\$6.75	\$1.23	\$0.41	\$0.00	\$9.81	\$0.60	\$0.00	\$0.00	\$59.68	\$80.12
Operator B	\$36.20	\$6.75	\$1.09	\$0.36	\$0.00	\$8.69	\$0.60	\$0.00	\$0.00	\$53.69	\$71.79
Operator C	\$29.12	\$6.75	\$0.87	\$0.29	\$0.00	\$6.99	\$0.60	\$0.00	\$0.00	\$44.62	\$59.18
Groundman 0-12 months Exp	\$22.81	\$6.75	\$0.68	\$0.23	\$0.00	\$5.47	\$0.60	\$0.00	\$0.00	\$36.54	\$47.94
Groundman 0-12 months Exp w/CDL	\$25.09	\$6.75	\$0.75	\$0.25	\$0.00	\$6.02	\$0.60	\$0.00	\$0.00	\$39.46	\$52.01
Groundman 1 yr or more	\$25.09	\$6.75	\$0.75	\$0.25	\$0.00	\$6.02	\$0.60	\$0.00	\$0.00	\$39.46	\$52.01
Groundman 1 yr or more w/CDL	\$29.65	\$6.75	\$0.85	\$0.28	\$0.00	\$6.50	\$0.60	\$0.00	\$0.00	\$44.63	\$59.46
Equipment Mechanic A	\$36.20	\$6.75	\$1.09	\$0.36	\$0.00	\$8.69	\$0.60	\$0.00	\$0.00	\$53.69	\$71.79
Equipment Mechanic B	\$32.66	\$6.75	\$0.98	\$0.33	\$0.00	\$7.84	\$0.60	\$0.00	\$0.00	\$49.16	\$65.49
Equipment Mechanic C	\$29.12	\$6.75	\$0.87	\$0.29	\$0.00	\$6.99	\$0.60	\$0.00	\$0.00	\$44.62	\$59.18
X-Ray Technician	\$45.61	\$6.75	\$1.37	\$0.46	\$0.00	\$10.95	\$0.60	\$0.00	\$0.00	\$65.74	\$88.54

Apprentice	Percent											
1st 1000 hrs	60.00	\$27.37	\$6.75	\$0.82	\$0.27	\$0.00	\$6.57	\$0.60	\$0.00	\$0.00	\$42.38	\$56.06
2nd 1000 hrs	65.00	\$29.65	\$6.75	\$0.89	\$0.30	\$0.00	\$7.12	\$0.60	\$0.00	\$0.00	\$45.31	\$60.13
3rd 1000 hrs	70.00	\$31.93	\$6.75	\$0.96	\$0.32	\$0.00	\$7.66	\$0.60	\$0.00	\$0.00	\$48.22	\$64.18
4th 1000 hrs	75.00	\$34.21	\$6.75	\$1.03	\$0.34	\$0.00	\$8.21	\$0.60	\$0.00	\$0.00	\$51.14	\$68.24
5th 1000 hrs	80.00	\$36.49	\$6.75	\$1.09	\$0.36	\$0.00	\$8.76	\$0.60	\$0.00	\$0.00	\$54.05	\$72.29
6th 1000 hrs	85.00	\$38.77	\$6.75	\$1.16	\$0.39	\$0.00	\$9.30	\$0.60	\$0.00	\$0.00	\$56.97	\$76.35
7th 1000 hrs	90.00	\$41.05	\$6.75	\$1.23	\$0.41	\$0.00	\$9.85	\$0.60	\$0.00	\$0.00	\$59.89	\$80.41

Special Calculation Note : Other is Health Retirement Account

Operator "A"

John Henry Rock Drill, D-6 (or equivalent) and above, Trackhoe Digger, (320 Track excavator), Cranes (greater then 25 tons and less than 45 tons).

Operator "B"

Cranes (greater than 6 tons and up to 25 tons), Backhoes, Road Tractor, Dozer up to D-5, Pressure Digger- wheeled or tracked, all Tension wire Stringing equipment.

Operator "C"

Trench, Backhoe, Riding type vibratory Compactor, Ground Rod Driver, Boom Truck (6 ton & below), Skid Steer Loaders, Material Handler.

*All Operators of cranes 45 ton or larger shall be paid the journeyman rate of pay. \$0.30 is for Health Retirement Account.

Ratio :

1 Journeyman to 1 Apprentice

Jurisdiction (* denotes special jurisdictional note) :

ADAMS, ASHLAND, ASHTABULA, ATHENS, AUGLAIZE, BELMONT, BROWN, BUTLER, CARROLL, CHAMPAIGN, CLARK, CLERMONT, CLINTON, COLUMBIANA, COSHOCTON, CRAWFORD, CUYAHOGA, DARKE, DELAWARE, FAIRFIELD, FAYETTE, FRANKLIN, GALLIA, GEAUGA, GREENE, GUERNSEY, HAMILTON, HARRISON, HIGHLAND, HOCKING, HOLMES, JACKSON, JEFFERSON, KNOX, LAKE, LAWRENCE, LICKING, LOGAN, LORAIN, MADISON, MAHONING, MARION, MEDINA, MEIGS, MERCER, MIAMI, MONROE, MONTGOMERY, MORGAN, MORROW, MUSKINGUM, NOBLE, PERRY, PICKAWAY, PIKE, PORTAGE, PREBLE, RICHLAND, ROSS, SCIOTO, SHELBY, STARK, SUMMIT, TRUMBULL,

TUSCARAWAS, UNION, VINTON, WARREN,
WASHINGTON, WAYNE

Special Jurisdictional Note :

Details :

Heli - Arc Welding will be paid \$.30 above Journeyman rate. Additional compensation of 10% over the Journeyman Lineman and Journeyman Technician for performing work on structures outside of buildings such as water towers, smoke stacks, radio and television towers, more than 75' above the ground.

Prevailing Wage Rate Skilled Crafts

Name of Union: Electrical Local 71 Outside Utility Power

Change # : LCN01-2021fbLoc7

Craft : Lineman Effective Date : 03/16/2021 Last Posted : 03/16/2021

	BHR	Fringe Benefit Payments						Irrevocable Fund		Total PWR	Overtime Rate
		H&W	Pension	App Tr.	Vac.	Annuity	Other	LECET (*)	MISC (*)		
Classification											
Electrical Lineman	\$43.22	\$6.75	\$1.30	\$0.43	\$0.00	\$10.37	\$0.60	\$0.00	\$0.00	\$62.67	\$84.28
Substation Technician	\$43.22	\$6.75	\$1.30	\$0.43	\$0.00	\$10.37	\$0.60	\$0.00	\$0.00	\$62.67	\$84.28
Cable Splicer	\$45.26	\$6.75	\$1.36	\$0.45	\$0.00	\$10.86	\$0.60	\$0.00	\$0.00	\$65.28	\$87.91
Operator A	\$38.75	\$6.75	\$1.16	\$0.39	\$0.00	\$9.30	\$0.60	\$0.00	\$0.00	\$56.95	\$76.32
Operator B	\$34.27	\$6.75	\$1.03	\$0.34	\$0.00	\$8.22	\$0.60	\$0.00	\$0.00	\$51.21	\$68.34
Operator C	\$27.54	\$6.75	\$0.83	\$0.28	\$0.00	\$6.61	\$0.60	\$0.00	\$0.00	\$42.61	\$56.38
Groundman 0-12 months Exp	\$21.61	\$6.75	\$0.65	\$0.22	\$0.00	\$5.19	\$0.60	\$0.00	\$0.00	\$35.02	\$45.82
Groundman 0-12 months Exp w/CDL	\$23.77	\$6.75	\$0.71	\$0.24	\$0.00	\$5.70	\$0.60	\$0.00	\$0.00	\$37.77	\$49.66
Groundman 1 yr or more	\$23.77	\$6.75	\$0.71	\$0.24	\$0.00	\$5.70	\$0.60	\$0.00	\$0.00	\$37.77	\$49.66
Groundman 1 yr or more w/CDL	\$28.09	\$6.75	\$0.84	\$0.28	\$0.00	\$6.74	\$0.60	\$0.00	\$0.00	\$43.30	\$57.35
Equipment Mechanic A	\$34.27	\$6.75	\$1.03	\$0.34	\$0.00	\$8.22	\$0.60	\$0.00	\$0.00	\$51.21	\$68.34
Equipment Mechanic B	\$30.91	\$6.75	\$0.93	\$0.31	\$0.00	\$7.42	\$0.60	\$0.00	\$0.00	\$46.92	\$62.38
Equipment Mechanic C	\$27.54	\$6.75	\$0.83	\$0.28	\$0.00	\$6.61	\$0.60	\$0.00	\$0.00	\$42.61	\$56.38
Line Truck w/uuger	\$30.44	\$6.75	\$0.91	\$0.30	\$0.00	\$7.31	\$0.60	\$0.00	\$0.00	\$46.31	\$61.53
Apprentice	Percent										

1st 1000 hrs	60.00	\$25.93	\$6.75	\$0.78	\$0.26	\$0.00	\$6.22	\$0.60	\$0.00	\$0.00	\$40.54	\$53.51
2nd 1000 hrs	65.00	\$28.09	\$6.75	\$0.84	\$0.28	\$0.00	\$6.74	\$0.60	\$0.00	\$0.00	\$43.30	\$57.35
3rd 1000 hrs	70.00	\$30.25	\$6.75	\$0.91	\$0.30	\$0.00	\$7.26	\$0.60	\$0.00	\$0.00	\$46.07	\$61.20
4th 1000 hrs	75.00	\$32.42	\$6.75	\$0.97	\$0.32	\$0.00	\$7.78	\$0.60	\$0.00	\$0.00	\$48.84	\$65.04
5th 1000 hrs	80.00	\$34.58	\$6.75	\$1.04	\$0.35	\$0.00	\$8.30	\$0.60	\$0.00	\$0.00	\$51.62	\$68.90
6th 1000 hrs	85.00	\$36.74	\$6.75	\$1.10	\$0.37	\$0.00	\$8.82	\$0.60	\$0.00	\$0.00	\$54.38	\$72.75
7th 1000 hrs	90.00	\$38.90	\$6.75	\$1.17	\$0.39	\$0.00	\$9.34	\$0.60	\$0.00	\$0.00	\$57.15	\$76.60

Special Calculation Note : Other is Health Retirement Account

Operator "A"

John Henry Rock Drill, D-6 (or equivalent) and above, Trackhoe Digger, (320 Track excavator), Cranes (greater than 25 tons and less than 45 tons).

Operator "B"

Cranes (greater than 6 tons and up to 25 tons), Backhoes, Road Tractor, Dozer up to D-5, Pressure Digger- wheeled or tracked, all Tension wire Stringing equipment.

Operator "C"

Trench, Backhoe, Riding type vibratory Compactor, Ground Rod Driver, Boom Truck (6 ton & below), Skid Steer Loaders, Material Handler.

Ratio :

(1) Journeyman Lineman to (1) Apprentice

Jurisdiction (* denotes special jurisdictional note) :

ADAMS, ASHLAND, ASHTABULA, ATHENS, AUGLAIZE, BELMONT, BROWN, BUTLER, CARROLL, CHAMPAIGN, CLARK, CLERMONT, CLINTON, COLUMBIANA, COSHOCTON, CRAWFORD, CUYAHOGA, DARKE, DELAWARE, FAIRFIELD, FAYETTE, FRANKLIN, GALLIA, GEAUGA, GREENE, GUERNSEY, HAMILTON, HARRISON, HIGHLAND, HOCKING, HOLMES, JACKSON, JEFFERSON, KNOX, LAKE, LAWRENCE, LICKING, LOGAN, LORAIN, MADISON, MAHONING, MARION, MEDINA, MEIGS, MERCER, MIAMI, MONROE, MONTGOMERY, MORGAN, MORROW, MUSKINGUM, NOBLE, PERRY, PICKAWAY, PIKE, PORTAGE, PREBLE, RICHLAND, ROSS, SCIOTO, SHELBY, STARK, SUMMIT, TRUMBULL, TUSCARAWAS, UNION, VINTON, WARREN, WASHINGTON, WAYNE

Special Jurisdictional Note : 0.30 is for Health Retirement Account.

Details :

Heli - Arc Welding will be paid \$.30 above Journeyman rate. Additional compensation of 10% over the Journeyman Lineman and Journeyman Technician for performing work on structures outside of buildings such

as water towers, smoke stacks, radio and television towers, more than 75' above the ground.

Prevailing Wage Rate Skilled Crafts

Name of Union: Electrical Local 71 Voice Data Video Outside

Change # : LCR01-2017fbLoc71VDV

Craft : Voice Data Video Effective Date : 10/18/2017 Last Posted : 10/18/2017

	BHR	Fringe Benefit Payments						Irrevocable Fund		Total PWR	Overtime Rate
		H&W	Pension	App Tr.	Vac.	Annuity	Other	LECET (*)	MISC (*)		
Classification											
Electrical Installer Technician I	\$23.46	\$5.50	\$0.70	\$0.00	\$0.00	\$0.30	\$0.00	\$0.00	\$0.00	\$29.96	\$41.69
Installer Technician II	\$22.37	\$5.50	\$0.67	\$0.00	\$0.00	\$0.30	\$0.00	\$0.00	\$0.00	\$28.84	\$40.03
Equipment Operator I	\$22.37	\$5.50	\$0.67	\$0.00	\$0.00	\$0.30	\$0.00	\$0.00	\$0.00	\$28.84	\$40.03
Equipment Operator II	\$18.43	\$5.50	\$0.55	\$0.00	\$0.00	\$0.30	\$0.00	\$0.00	\$0.00	\$24.78	\$33.99
Installer /Repair Outside	\$22.37	\$5.50	\$0.67	\$0.00	\$0.00	\$0.30	\$0.00	\$0.00	\$0.00	\$28.84	\$40.03
Ground Driver W/CDL	\$15.83	\$5.50	\$0.47	\$0.00	\$0.00	\$0.30	\$0.00	\$0.00	\$0.00	\$22.10	\$30.01
Groundman	\$13.24	\$5.50	\$0.40	\$0.00	\$0.00	\$0.30	\$0.00	\$0.00	\$0.00	\$19.44	\$26.06
Cable Splicer	\$23.46	\$5.50	\$0.70	\$0.00	\$0.00	\$0.30	\$0.00	\$0.00	\$0.00	\$29.96	\$41.69

Special Calculation Note :

Ratio :

Jurisdiction (* denotes special jurisdictional note) :

ADAMS, ASHLAND, ASHTABULA, ATHENS, AUGLAIZE, BELMONT, BROWN, BUTLER, CARROLL, CHAMPAIGN, CLARK, CLERMONT, CLINTON, COLUMBIANA, COSHOCTON, CRAWFORD, CUYAHOGA, DARKE, DELAWARE, FAIRFIELD, FAYETTE, FRANKLIN, GALLIA, GEAUGA, GREENE, GUERNSEY, HAMILTON, HARRISON, HIGHLAND, HOCKING, HOLMES, JACKSON, JEFFERSON, KNOX, LAKE, LAWRENCE, LICKING, LOGAN, LORAIN, MADISON, MAHONING, MARION, MEDINA, MEIGS, MERCER, MIAMI, MONROE, MONTGOMERY, MORGAN, MORROW,

MUSKINGUM, NOBLE, PERRY, PICKAWAY,
PIKE, PORTAGE, PREBLE, RICHLAND, ROSS,
SCIOTO, SHELBY, STARK, SUMMIT,
TRUMBULL, TUSCARAWAS, UNION,
VINTON, WARREN, WASHINGTON, WAYNE

Special Jurisdictional Note :

Details :

Cable Splicer: Inspect and test lines or cables, analyze results, and evaluate transmission characteristics. Cover conductors with insulation or seal splices with moisture-proof covering. Install, splice, test, and repair cables using tools or mechanical equipment. This will include the splicing of fiber.

Journeyman Technician I: Must know all aspects of telephone and cable work. This is to include aerial, underground, and manhole work. Must know how to climb and run bucket. Must have all the tools required to perform these tasks. Must be able to be responsible for the safety of the crew at all times. Must also have CDL license and have at least 5 years experience.

Installer/Repairman: Perform tasks of repairing, installing, and testing phone and CATV services.

Technician II: Have at least three years of telephone and CATV experience. Must have the knowledge of underground, aerial, and manhole work. Must be able to climb and operate bucket. Must have CDL. Must have all tools needed to perform these tasks.

Equipment Operator I: Able to operate a digger derrick or bucket truck. Have at least 5 years of experience and must have a valid CDL license.

Equipment Operator II: Able to operate a digger derrick or bucket truck. Have at least 3 years of experience and must have a valid CDL license.

Groundman W/CDL: Must have a valid CDL license and be able to perform tasks such as: climbing poles, pulling downguys, making up material, and getting appropriate tools for the job. Must have at least 5 year's experience.

Groundman: Perform tasks such as: climbing poles, pulling downguys, making up material, and getting appropriate tools for the job. Experience 0-5 years.

Prevailing Wage Rate Skilled Crafts

Name of Union: Electrical Local 82 Inside

Change # : LCN01-2020fbLoc82in

Craft : Electrical Effective Date : 11/30/2020 Last Posted : 11/18/2020

	BHR		Fringe Benefit Payments					Irrevocable Fund		Total PWR	Overtime Rate	
			H&W	Pension	App Tr.	Vac.	Annuity	Other	LECET (*)			MISC (*)
Classification												
Electrician	\$32.15		\$7.45	\$9.31	\$0.55	\$0.00	\$3.20	\$0.00	\$0.00	\$0.00	\$52.66	\$68.73
Apprentice	Percent											
1st period 0 - 1000 hrs	42.00	\$13.50	\$4.07	\$0.61	\$0.23	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$18.41	\$25.16
2nd period 1001-2000 hrs	42.00	\$13.50	\$4.07	\$0.61	\$0.23	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$18.41	\$25.16
3rd period 2001-3500 hrs	47.00	\$15.11	\$6.92	\$4.37	\$0.26	\$0.00	\$1.50	\$0.00	\$0.00	\$0.00	\$28.16	\$35.72
4th period 3501-5000 hrs	52.00	\$16.72	\$6.97	\$4.84	\$0.28	\$0.00	\$1.66	\$0.00	\$0.00	\$0.00	\$30.47	\$38.83
5th period 5001-6500 hrs	62.00	\$19.93	\$7.07	\$5.78	\$0.34	\$0.00	\$1.98	\$0.00	\$0.00	\$0.00	\$35.10	\$45.07
6th period 6501-8000 hrs	77.00	\$24.76	\$7.22	\$7.17	\$0.42	\$0.00	\$2.46	\$0.00	\$0.00	\$0.00	\$42.03	\$54.40

Special Calculation Note : No special calculations for this skilled craft wage rate are required at this time.

Ratio :

1 to 3 Journeymen to 3 Apprentices
4 to 6 Journeymen to 6 Apprentices
per job site

Jurisdiction (* denotes special jurisdictional note) :

CLINTON, DARKE, GREENE, MIAMI,
MONTGOMERY, PREBLE, WARREN*

Special Jurisdictional Note : The following townships in Warren County are included:
Clearcreek, Franklin and Wayne.

Details :

Prevailing Wage Rate Skilled Crafts

Name of Union: Electrical Local 82 Inside Lt Commercial South West

Change # : LCNO2-2020fbLoc82in

Craft : Electrical Effective Date : 01/01/2021 Last Posted : 12/24/2020

Classification	BHR	Fringe Benefit Payments						Irrevocable Fund		Total PWR	Overtime Rate
		H&W	Pension	App Tr.	Vac.	Annuity	Other	LECET (*)	MISC (*)		
Electrician	\$32.15	\$6.35	\$9.31	\$0.68	\$0.00	\$3.20	\$0.00	\$0.00	\$0.00	\$51.69	\$67.76
CE-3 12,001-14,000	\$23.03	\$6.35	\$0.69	\$0.68	\$0.00	\$0.68	\$0.00	\$0.00	\$0.10	\$31.53	\$43.05
CE-2 10,001-12,000 Hrs	\$18.10	\$6.35	\$0.54	\$0.68	\$0.00	\$0.54	\$0.00	\$0.00	\$0.10	\$26.31	\$35.36
CE-1 8,001-10,000 Hrs	\$16.45	\$6.35	\$0.49	\$0.68	\$0.00	\$0.49	\$0.00	\$0.00	\$0.10	\$24.56	\$32.79
CW-4 6,001-8,000 Hrs	\$14.81	\$6.35	\$0.44	\$0.68	\$0.00	\$0.44	\$0.00	\$0.00	\$0.10	\$22.82	\$30.23
CW-3 4,001-6,000 Hrs	\$13.16	\$6.35	\$0.39	\$0.68	\$0.00	\$0.39	\$0.00	\$0.00	\$0.10	\$21.07	\$27.65
CW-2 2,001-4,000 Hrs	\$12.34	\$6.35	\$0.37	\$0.68	\$0.00	\$0.37	\$0.00	\$0.00	\$0.10	\$20.21	\$26.38
CW-1 0-2,000 Hrs	\$11.52	\$6.35	\$0.35	\$0.68	\$0.00	\$0.35	\$0.00	\$0.00	\$0.10	\$19.35	\$25.11
Apprentice	Percent										
1st period 0 - 1000 hrs	42.00	\$13.50	\$4.07	\$0.20	\$0.23	\$0.00	\$0.00	\$0.00	\$0.00	\$18.00	\$24.75
2nd period 1001-2000 hrs	42.00	\$13.50	\$4.07	\$0.20	\$0.23	\$0.00	\$0.00	\$0.00	\$0.00	\$18.00	\$24.75
3rd period 2001-3500 hrs	47.00	\$15.11	\$6.92	\$3.92	\$0.26	\$1.50	\$0.00	\$0.00	\$0.00	\$27.71	\$35.27
4th period 3501-5000 hrs	52.00	\$16.72	\$6.97	\$4.34	\$0.28	\$1.66	\$0.00	\$0.00	\$0.00	\$29.97	\$38.33
	62.00	\$19.93	\$7.07	\$5.18	\$0.34	\$1.98	\$0.00	\$0.00	\$0.00	\$34.50	\$44.47

5th period 5001-6500 hrs												
6th period 6501-8000 hrs	77.00	\$24.76	\$7.22	\$6.43	\$0.42	\$0.00	\$2.46	\$0.00	\$0.00	\$0.00	\$41.29	\$53.66

Special Calculation Note : No special calculations for this skilled craft wage rate are required at this time.

Ratio :

1 to 3 Journeymen to 3 Apprentices
 4 to 6 Journeymen to 6 Apprentices
 per job site

Jurisdiction (* denotes special jurisdictional note) :

CLINTON, DARKE, GREENE, MIAMI,
 MONTGOMERY, PREBLE, WARREN*

Construction Electrician and Construction Wireman Ratio

There shall be a minimum ratio of one inside Journeyman to every (4) employees of different classification per jobsite. An inside Journeyman Wireman is required on the project as the fifth (5th) worker or when apprentices are used.

Special Jurisdictional Note : The following townships in Warren County are included: Clearcreek, Franklin and Wayne.

The scope of work for the light commercial agreement shall apply to the following facilities not to exceed 200,000 square feet; office buildings, shopping centers, auto sales agencies and garages, churches, funeral homes, nursing homes, hotels, retail and wholesale facilities, small stand-alone manufacturing facilities when free standing and not part of a larger facility (not to exceed 50,000 square fee), solar projects (500 panels or less) unless otherwise covered under the agreement, lighting retrofits (when not associated with remodels involving branch re-circuiting) lighting retrofits shall be defined as the changing of lamps and ballasts in existing light fixtures and shall also include the one for one replacement of existing fixtures, warehouses, gas stations, food service centers, restaurants, entertainment facilities, hospitals, clinics, motels, residential buildings.

Details :

Prevailing Wage Rate Skilled Crafts

Name of Union: Electrical Local 82 Lightning Rod

Change # : LCR01-2020fbLoc82

Craft : Electrical Effective Date : 11/30/2020 Last Posted : 11/25/2020

	BHR	Fringe Benefit Payments						Irrevocable Fund		Total PWR	Overtime Rate
		H&W	Pension	App Tr.	Vac.	Annuity	Other	LECET (*)	MISC (*)		
Classification											
Electrical Lightning Rod Technican	\$30.79	\$7.45	\$9.27	\$0.00	\$0.00	\$3.20	\$0.00	\$0.00	\$0.00	\$50.71	\$66.10

Special Calculation Note : No Apprentice approved by OSAC.

Ratio :

Jurisdiction (* denotes special jurisdictional note) :
 CLINTON, DARKE, GREENE, MIAMI,
 MONTGOMERY, PREBLE, WARREN*

Special Jurisdictional Note : The following townships in Warren County are included:
 (Clearcreek, Franklin and Wayne)

Details :

Prevailing Wage Rate Skilled Crafts

Name of Union: Electrical Local 82 Voice Data Video

Change # : LCR01-2020fbLoc82VDV

Craft : Voice Data Video Effective Date : 11/30/2020 Last Posted : 11/18/2020

Classification	BHR	Fringe Benefit Payments						Irrevocable Fund	Total PWR	Overtime Rate	
		H&W	Pension	App Tr.	Vac.	Annuity	Other	LECET (*)	MISC (*)		
Electrical Installer Technician A	\$25.10	\$6.60	\$0.75	\$0.48	\$0.00	\$4.40	\$0.00	\$0.00	\$0.00	\$37.33	\$49.88
Electrical Installer Technician B	\$23.85	\$6.60	\$0.72	\$0.45	\$0.00	\$4.40	\$0.00	\$0.00	\$0.00	\$36.02	\$47.95
JW Installer Technician	\$22.59	\$6.60	\$0.68	\$0.43	\$0.00	\$4.40	\$0.00	\$0.00	\$0.00	\$34.70	\$46.00
NON BICSI Installer	\$16.32	\$3.00	\$0.49	\$0.31	\$0.00	\$2.00	\$0.00	\$0.00	\$0.00	\$22.12	\$30.28
Apprentice Indentured Before 09-03-2018											
1st Period 0-800 Hrs	\$12.55	\$6.60	\$0.38	\$0.24	\$0.00	\$0.25	\$0.00	\$0.00	\$0.00	\$20.02	\$26.30
2nd Period 801-1600 Hrs	\$12.55	\$6.60	\$0.38	\$0.24	\$0.00	\$0.25	\$0.00	\$0.00	\$0.00	\$20.02	\$26.30
3rd Period 1601-2400 Hrs	\$15.06	\$6.60	\$0.45	\$0.29	\$0.00	\$4.40	\$0.00	\$0.00	\$0.00	\$26.80	\$34.33
4th Period 2401-3200 Hrs	\$16.32	\$6.60	\$0.49	\$0.31	\$0.00	\$4.40	\$0.00	\$0.00	\$0.00	\$28.12	\$36.28
5th Period 3201-4000 Hrs	\$17.57	\$6.60	\$0.53	\$0.33	\$0.00	\$4.40	\$0.00	\$0.00	\$0.00	\$29.43	\$38.21
6th Period 4001 Hours	\$18.83	\$6.60	\$0.56	\$0.36	\$0.00	\$4.40	\$0.00	\$0.00	\$0.00	\$30.75	\$40.17
	\$12.55	\$3.00	\$0.38	\$0.24	\$0.00	\$0.25	\$0.00	\$0.00	\$0.00	\$16.42	\$22.69

Cable Puller												
Apprentice Indentured After 09-04-2018	Percent											
1st 0-1000 hours	55.00	\$13.81	\$3.00	\$0.41	\$0.26	\$0.00	\$0.25	\$0.00	\$0.00	\$0.00	\$17.73	\$24.63
2nd 1001-2000 hours	55.00	\$13.81	\$3.00	\$0.41	\$0.26	\$0.00	\$0.25	\$0.00	\$0.00	\$0.00	\$17.73	\$24.63
3rd 2001-3000 hours	65.00	\$16.32	\$6.50	\$0.49	\$0.31	\$0.00	\$4.40	\$0.00	\$0.00	\$0.00	\$28.01	\$36.17
4th 3001-4000 hours	65.00	\$16.32	\$6.50	\$0.49	\$0.31	\$0.00	\$4.40	\$0.00	\$0.00	\$0.00	\$28.01	\$36.17
5th 4001-5000 hours	75.00	\$18.83	\$6.53	\$0.56	\$0.36	\$0.00	\$4.40	\$0.00	\$0.00	\$0.00	\$30.68	\$40.09
6th 5001-6000 hours	75.00	\$18.83	\$6.53	\$0.56	\$0.36	\$0.00	\$4.40	\$0.00	\$0.00	\$0.00	\$30.68	\$40.09
7th 6001-7000 hours	80.00	\$20.08	\$6.54	\$0.60	\$0.38	\$0.00	\$4.40	\$0.00	\$0.00	\$0.00	\$32.00	\$42.04
8th 7001 hours	80.00	\$20.08	\$6.54	\$0.60	\$0.38	\$0.00	\$4.40	\$0.00	\$0.00	\$0.00	\$32.00	\$42.04
Cable Puller	50.00	\$12.55	\$3.00	\$0.38	\$0.24	\$0.00	\$0.25	\$0.00	\$0.00	\$0.00	\$16.42	\$22.69

Special Calculation Note : No special calculations for this skilled craft wage rate are required at this time.

Ratio :

1 Journeymen to 2 Apprentice
(Indentured After 9-4-2018)

1 Journeymen to 1 Apprentice
(Indentured Before 9--03-2018)

Jurisdiction (* denotes special jurisdictional note) :

CLINTON, DARKE, GREENE, MIAMI, MONTGOMERY, PREBLE, WARREN*

Special Jurisdictional Note : The following townships in Warren County are included: (Clearcreek, Franklin and Wayne)

Details :

Work covered but not limited to: installation which utilize transmission and/or transference of voice, sound, vision or digital for commercial, education, security and entertainment purposes for the following:

TV monitoring and surveillance, background-foreground music, intercom and telephone interconnect, inventory control systems, microwave transmission, multimedia, multiplex, nurse call system, radio page, school intercom, sound and low voltage master clock systems.

Fire Alarm work is excluded on all new construction sites or wherever the fire alarm system is installed in conduit.

Prevailing Wage Rate Skilled Crafts

Name of Union: Elevator Local 11

Change # : LCN01-2020fbLoc11

Craft : Elevator Effective Date : 01/05/2021 Last Posted : 01/05/2021

	BHR		Fringe Benefit Payments						Irrevocable Fund		Total PWR	Overtime Rate
			H&W	Pension	App Tr.	Vac.	Annuity	Other	LECET (*)	MISC (*)		
Classification												
Elevator Mechanic	\$48.82		\$15.88	\$10.46	\$0.64	\$3.91	\$8.85	\$1.56	\$0.00	\$0.00	\$90.12	\$114.53
Probationary Apprentice	50.00	\$24.41	\$0.00	\$0.00	\$0.00	\$1.46	\$0.00	\$0.78	\$0.00	\$0.00	\$26.65	\$38.86
1st year	55.00	\$26.85	\$15.88	\$10.46	\$0.64	\$1.61	\$8.85	\$0.86	\$0.00	\$0.00	\$65.15	\$78.58
2nd year	65.00	\$31.73	\$15.88	\$10.46	\$0.64	\$1.90	\$8.85	\$1.02	\$0.00	\$0.00	\$70.48	\$86.35
3rd year	70.00	\$34.17	\$15.88	\$10.46	\$0.64	\$2.05	\$8.85	\$1.09	\$0.00	\$0.00	\$73.14	\$90.23
4th year	80.00	\$39.06	\$15.88	\$10.46	\$0.64	\$2.34	\$8.85	\$1.25	\$0.00	\$0.00	\$78.48	\$98.00
Helper	70.00	\$34.17	\$15.88	\$10.46	\$0.64	\$2.05	\$8.85	\$1.09	\$0.00	\$0.00	\$73.14	\$90.23
Assistant Mechanic	80.00	\$39.06	\$15.88	\$10.46	\$0.64	\$2.34	\$8.85	\$1.25	\$0.00	\$0.00	\$78.48	\$98.00

Special Calculation Note : Other is Holiday Pay. Vacation calculated at 6%.

Ratio :

The total number of Helpers & Apprentices employed shall not exceed the number of Mechanics on any one job, except on jobs where (2) teams or more are working, (1) extra Helper or Apprentice may be employed for the first (2) teams and an extra Helper or Apprentice for each additional (3) teams.

- 1 Journeymen to 1 Apprentice
- 2 Journeymen to 5 Apprentice
- 3 Journeymen to 6 Apprentice

Jurisdiction (* denotes special jurisdictional note) :

ADAMS, BROWN, BUTLER, CLERMONT, CLINTON, DARKE, GREENE, HAMILTON, HIGHLAND, MIAMI, MONTGOMERY, PREBLE, SCIOTO, SHELBY, WARREN

Special Jurisdictional Note :

Details :

Prevailing Wage Rate Skilled Crafts

Name of Union: Glazier Local 387

Change # : LCN01-2020fbLoc387

Craft : Glazier Effective Date : 11/01/2020 Last Posted : 10/28/2020

	BHR		Fringe Benefit Payments					Irrevocable Fund		Total PWR	Overtime Rate	
			H&W	Pension	App Tr.	Vac.	Annuity	Other	LECET (*)			MISC (*)
Classification												
Glazier	\$27.93		\$5.67	\$10.10	\$0.25	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$43.95	\$57.92
Apprentice	Percent											
1st 6 months	53.70	\$15.00	\$5.67	\$0.00	\$0.25	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$20.92	\$28.42
2nd 6 months	65.00	\$18.15	\$5.67	\$6.19	\$0.25	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$30.26	\$39.34
3rd 6 months	70.00	\$19.55	\$5.67	\$6.71	\$0.25	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$32.18	\$41.96
4th 6 months	75.00	\$20.95	\$5.67	\$6.85	\$0.25	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$33.72	\$44.19
5th 6 months	80.00	\$22.34	\$5.67	\$7.43	\$0.25	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$35.69	\$46.87
6th 6 months	85.00	\$23.74	\$5.67	\$7.57	\$0.25	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$37.23	\$49.10
7th 6 months	90.00	\$25.14	\$5.67	\$8.09	\$0.25	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$39.15	\$51.72
8th 6 months	95.00	\$26.53	\$5.67	\$8.68	\$0.25	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$41.13	\$54.40

Special Calculation Note : No special calculations for this skilled craft wage rate are required at this time.

Ratio :

Each employer may employ and train Apprentices in the following ratio to journeymen workers employed.
1 Journeymen to 1 Apprentice

Jurisdiction (* denotes special jurisdictional note) :

ADAMS, BROWN, BUTLER, CHAMPAIGN, CLARK, CLERMONT, CLINTON, DARKE, FAYETTE*, GREENE, HAMILTON, HIGHLAND, MIAMI, MONTGOMERY, PREBLE, SHELBY*, WARREN

Special Jurisdictional Note : Fayette County: Eastern portion of route #41 being the dividing line between locals 372 and 387. Local 387 has jurisdiction of projects built on property which borders route #41 East. Shelby County: Southern portion of routes #47 & 29.

Prevailing Wage Rate Skilled Crafts

Name of Union: Ironworker Local 290

Change # : LCN01-2021fbLoc290

Craft : Ironworker Effective Date : 01/27/2021 Last Posted : 01/27/2021

	BHR		Fringe Benefit Payments					Irrevocable Fund		Total PWR	Overtime Rate	
			H&W	Pension	App Tr.	Vac.	Annuity	Other	LECET (*)			MISC (*)
Classification												
Ironworker Structural	\$29.68		\$8.30	\$9.50	\$0.65	\$0.00	\$4.45	\$0.02	\$0.00	\$0.00	\$52.60	\$67.44
Welder	\$29.68		\$8.30	\$9.50	\$0.65	\$0.00	\$4.45	\$0.02	\$0.00	\$0.00	\$52.60	\$67.44
Fence Erector	\$29.68		\$8.30	\$9.50	\$0.65	\$0.00	\$4.45	\$0.02	\$0.00	\$0.00	\$52.60	\$67.44
Reinforcing Rods	\$29.68		\$8.30	\$9.50	\$0.65	\$0.00	\$4.45	\$0.02	\$0.00	\$0.00	\$52.60	\$67.44
Machinery Mover	\$29.68		\$8.30	\$9.50	\$0.65	\$0.00	\$4.45	\$0.02	\$0.00	\$0.00	\$52.60	\$67.44
Sheeter	\$29.68		\$8.30	\$9.50	\$0.65	\$0.00	\$4.45	\$0.02	\$0.00	\$0.00	\$52.60	\$67.44
Metal Building Erector	\$29.68		\$8.30	\$9.50	\$0.65	\$0.00	\$4.45	\$0.02	\$0.00	\$0.00	\$52.60	\$67.44
Rigger & Erector	\$29.68		\$8.30	\$9.50	\$0.65	\$0.00	\$4.45	\$0.02	\$0.00	\$0.00	\$52.60	\$67.44
Apprentice	Percent											
1st year	65.05	\$19.31	\$8.30	\$9.50	\$0.65	\$0.00	\$2.95	\$0.02	\$0.00	\$0.00	\$40.73	\$50.38
2nd year	75.07	\$22.28	\$8.30	\$9.50	\$0.65	\$0.00	\$2.95	\$0.02	\$0.00	\$0.00	\$43.70	\$54.84
3rd year	85.05	\$25.24	\$8.30	\$9.50	\$0.65	\$0.00	\$2.95	\$0.02	\$0.00	\$0.00	\$46.66	\$59.28
4th year	95.05	\$28.21	\$8.30	\$9.50	\$0.65	\$0.00	\$2.95	\$0.02	\$0.00	\$0.00	\$49.63	\$63.74

Special Calculation Note : Other is for Industry Fund.

Ratio :

3 Journeymen to 1 Apprentice

Jurisdiction (* denotes special jurisdictional note) :

ALLEN*, AUGLAIZE, BUTLER*,
CHAMPAIGN*, CLARK, CLINTON, DARKE,
FAYETTE*, GREENE, HARDIN*,
HIGHLAND*, LOGAN*, MADISON*,
MERCER*, MIAMI, MONTGOMERY,
PREBLE, SHELBY, VAN WERT*, WARREN*

Special Jurisdictional Note : Allen County Twps included are: Auglaize, Perry, Shawnee,

Amanda, Spencer, Marion, Sugar Creek, American, Bath, Jackson. Butler County Twps included are: Milford, Wayne, Madison, Lemon. Champaign Cnty Twps included are: Union, Urbana, Jackson, Concord, Salem, Mad River, Johnson, Harrison, Adams. Fayette County Twps included are: Green, Jasper, Concord, Jefferson. Hardin County Twps included are: Round Head, Marion, Liberty. Highland County Twps included are: Fairfield, Penn, Union, Marshall, Liberty, Paint, Brush Creek. Logan County Twps included are: Richland, Stokes, Bloomfield, Washington, Harrison, McArthur, Lake, Liberty, Pleasant, Miami. Madison County Twps included are: Stokes. Mercer County Twps included are: Dublin, Washington, Jefferson, Recovery, Gibson, Union, Liberty, Butler, Granville, Center, Hopewell, Franklin, Marion. VanWert County Twps included are: Jennings. Warren County Twps included are: Franklin, Clear Creek, Turtle Creek, Wayne, Massie, Washington, Salem, Union.

Details :

Structural Iron Work but not limited to:field fabrication, all loading to and including the erecting,rigging,assembly,dismantling, placing, temporary and permanent securing by any means of all structural iron,steel,ornamental lead,bronze,brass,copper,aluminum,glass all ferrous and non ferrous metal and composite material, precast prestressed and post-stressed concrete structures. Bridges and bridge rails,bridge viaducts,bucks bulkheads,bumper and bumper post,canopies and unistrut canopies,corrugated ferrous and non ferrous sheets when attached to steel frames,columns,beams,bar-joists,trusses,grinders,roof decking,electrical supports,elevator cars,elevator fronts and enclosures,erection of steel towers,flag poles, gymnasium equipment,stadium and arena seating,jail cell work,jail cell beds,benches,bunks,chairs,tables,mirrors,jail cell access doors,rigging and installation of machinery and equipment(erecting,aligning,anchoring and dismantling, erection and dismantling of tower cranes,derrick monorail systems, Chicago booms,overhead cranes,gantries,material and personnel hoists,tanks,hoppers and conveyors. All pre-engineered metal buildings and their entirety including siding,roofing, gutters, downspouts and erection of all.

Ornamental Iron Work but not limited to:all work in connection with field fabrication,handling including loading/off loading,sorting,cutting,fastening,anchoring,bending,hoisting,placing,burning,welding,and tying,dismantling of all materials used in miscellaneous iron or steel, for stairs,hand railings,rolling doors, rolling gates,rolling shutters,fence,windows,curtain wall,erection and welding of all metal, sash,architectural and ornamental treatments, but not necessarily limited to all sizes and types of ornamental,steel iron,lead,bronze,brass,copper,aluminum,all ferrous and non ferrous metals and composite materials

Fence Erector Iron Worker but not limited to: All work in connection with the field fabrication and erection of chain link fence,which includes but not limited to the loading and of the fence fabric and posts also the installation of the above.

Prevailing Wage Rate Skilled Crafts

Name of Union: Labor HevHwy 3

Change # : LCN01-2021fbLocalHevHwy3

Craft : Laborer Group 1 Effective Date : 05/01/2021 Last Posted : 04/21/2021

	BHR		Fringe Benefit Payments					Irrevocable Fund		Total PWR	Overtime Rate	
			H&W	Pension	App Tr.	Vac.	Annuity	Other	LECET (*)	MISC (*)		
Classification												
Laborer Group 1	\$33.27		\$7.50	\$3.90	\$0.45	\$0.00	\$0.00	\$0.00	\$0.10	\$0.00	\$45.22	\$61.86
Group 2	\$33.44		\$7.50	\$3.90	\$0.45	\$0.00	\$0.00	\$0.00	\$0.10	\$0.00	\$45.39	\$62.11
Group 3	\$33.77		\$7.50	\$3.90	\$0.45	\$0.00	\$0.00	\$0.00	\$0.10	\$0.00	\$45.72	\$62.61
Group 4	\$34.22		\$7.50	\$3.90	\$0.45	\$0.00	\$0.00	\$0.00	\$0.10	\$0.00	\$46.17	\$63.28
Watch Person	\$26.00		\$7.50	\$3.90	\$0.45	\$0.00	\$0.00	\$0.00	\$0.10	\$0.00	\$37.95	\$50.95
Apprentice	Percent											
0-1000 hrs	60.00	\$19.96	\$7.50	\$3.90	\$0.45	\$0.00	\$0.00	\$0.00	\$0.10	\$0.00	\$31.91	\$41.89
1001-2000 hrs	70.00	\$23.29	\$7.50	\$3.90	\$0.45	\$0.00	\$0.00	\$0.00	\$0.10	\$0.00	\$35.24	\$46.88
2001-3000 hrs	80.00	\$26.62	\$7.50	\$3.90	\$0.45	\$0.00	\$0.00	\$0.00	\$0.10	\$0.00	\$38.57	\$51.87
3001-4000 hrs	90.00	\$29.94	\$7.50	\$3.90	\$0.45	\$0.00	\$0.00	\$0.00	\$0.10	\$0.00	\$41.89	\$56.86
More than 4000 hrs	100.00	\$33.27	\$7.50	\$3.90	\$0.45	\$0.00	\$0.00	\$0.00	\$0.10	\$0.00	\$45.22	\$61.86

Special Calculation Note : Watchmen have no Apprentices. Tunnel Laborer rate with air-pressurized add \$1.00 to the above wage rate.

Ratio :

- 1 Journeymen to 1 Apprentice
- 3 Journeymen to 1 Apprentice thereafter

Jurisdiction (* denotes special jurisdictional note) :

- ADAMS, ALLEN, ASHLAND, ATHENS,
- AUGLAIZE, BELMONT, BROWN, BUTLER,
- CARROLL, CHAMPAIGN, CLARK,
- CLERMONT, CLINTON, COLUMBIANA,
- COSHOCTON, CRAWFORD, DARKE,
- DEFIANCE, DELAWARE, FAIRFIELD,
- FAYETTE, FRANKLIN, FULTON, GALLIA,
- GREENE, GUERNSEY, HAMILTON,
- HANCOCK, HARDIN, HARRISON, HENRY,
- HIGHLAND, HOCKING, HOLMES, JACKSON,

JEFFERSON, KNOX, LAWRENCE, LICKING,
 LOGAN, MADISON, MARION, MEIGS,
 MERCER, MIAMI, MONROE,
 MONTGOMERY, MORGAN, MORROW,
 MUSKINGUM, NOBLE, PAULDING, PERRY,
 PICKAWAY, PIKE, PREBLE, PUTNAM,
 RICHLAND, ROSS, SCIOTO, SENECA,
 SHELBY, TUSCARAWAS, UNION, VAN
 WERT, VINTON, WARREN, WASHINGTON,
 WAYNE, WILLIAMS, WYANDOT

Special Jurisdictional Note : Hod Carriers and Common Laborers - Heavy, Highway, Sewer, Waterworks, Utility, Airport, Railroad, Industrial and Building Site, Sewer Plant, Waste Water Treatment Facilities Construction

Details :

Group 1

Laborer (Construction); Plant Laborer or Yardman, Right-of-way Laborer, Landscape Laborer, Highway Lighting Worker, Signalization Worker, (Swimming) Pool Construction Laborer, Utility Man, *Bridge Man, Handyman, Joint Setter, Flagperson, Carpenter Helper, Waterproofing Laborer, Slurry Seal, Seal Coating, Surface Treatment or Road Mix Laborer, Riprap Laborer & Grouter, Asphalt Laborer, Dump Man (batch trucks), Guardrail & Fence Installer, Mesh Handler & Placer, Concrete Curing Applicator, Scaffold Erector, Sign Installer, Hazardous Waste (level D), Diver Helper, Zone Person and Traffic Control.

*Bridge Man will perform work as per the October 31, 1949, memorandum on concrete forms, by and between the United Brotherhood of Carpenters and Joiners of America and the Laborers' International Union of North America, which states in; "the moving, cleaning, oiling and carrying to the next point of erection, and the stripping of forms which are not to be re-used, and forms on all flat arch work shall be done by members of the Laborers' International Union of North America."

Group 2

Asphalt Raker, Screwman or Paver, Concrete Puddler, Kettle Man (pipeline), All Machine-Driven Tools (Gas, Electric, Air), Mason Tender, Brick Paver, Mortar Mixer, Skid Steer, Sheeting & Shoring Person, Surface Grinder Person, Screedperson, Water Blast, Hand Held Wand, Power Buggy or Power Wheelbarrow, Paint Striper, Plastic fusing Machine Operator, Rodding Machine Operator, Pug Mill Operator, Operator of All Vacuum Devices Wet or Dry, Handling of all Pumps 4 inches and under (gas, air or electric), Diver, Form Setter, Bottom Person, Welder Helper (pipeline), Concrete Saw Person, Cutting with Burning Torch, Pipe Layer, Hand Spiker (railroad), Underground Person (working in sewer and waterline, cleaning, repairing and reconditioning). Tunnel Laborer (without air), Caisson, Cofferdam (below 25 feet deep), Air Track and Wagon Drill, Sandblaster Nozzle Person, Hazardous Waste (level B), ***Lead Abatement, Hazardous Waste (level C)

***Includes the erecting of structures for the removal, including the encapsulation and containment of Lead abatement process.

Group 3

Blast and Powder Person, Muckers will be defined as shovel men working directly with the miners,

Wrencher (mechanical joints & utility pipeline), Yarnier, Top Lander, Hazardous Waste (level A), Concrete Specialist, Curb Setter and Cutter, Grade Checker, Concrete Crew in Tunnels. Utility pipeline Tappers, Waterline, Caulker, Signal Person will receive the rate equal to the rate paid the Laborer classification for which the Laborer is signaling.

Group 4

Miner, Welder, Gunite Nozzle Person

A.) The Watchperson shall be responsible to patrol and maintain a safe traffic zone including but not limited to barrels, cones, signs, arrow boards, message boards etc.

The responsibility of a watchperson is to see that the equipment, job and office trailer etc. are secure.

Prevailing Wage Rate Skilled Crafts

Name of Union: Labor Local 1410 Building

Change # : LCN01-2019bLoc1410

Craft : Laborer Effective Date : 07/03/2019 Last Posted : 07/03/2019

	BHR		Fringe Benefit Payments					Irrevocable Fund		Total PWR	Overtime Rate	
			H&W	Pension	App Tr.	Vac.	Annuity	Other	LECET (*)			MISC (*)
Classification												
Laborer Group 1	\$25.90		\$7.00	\$3.70	\$0.40	\$0.00	\$0.00	\$0.00	\$0.10	\$0.00	\$37.10	\$50.05
Group 2	\$26.50		\$7.00	\$3.70	\$0.40	\$0.00	\$0.00	\$0.00	\$0.10	\$0.00	\$37.70	\$50.95
Group 3	\$27.00		\$7.00	\$3.70	\$0.40	\$0.00	\$0.00	\$0.00	\$0.10	\$0.00	\$38.20	\$51.70
Apprentice	Percent											
Building Laborer 1-1000 hrs	60.00	\$15.54	\$7.00	\$3.70	\$0.40	\$0.00	\$0.00	\$0.00	\$0.10	\$0.00	\$26.74	\$34.51
1001-2000	70.02	\$18.14	\$7.00	\$3.70	\$0.40	\$0.00	\$0.00	\$0.00	\$0.10	\$0.00	\$29.34	\$38.40
2001-3000	80.00	\$20.72	\$7.00	\$3.70	\$0.40	\$0.00	\$0.00	\$0.00	\$0.10	\$0.00	\$31.92	\$42.28
3001-4000	90.00	\$23.31	\$7.00	\$3.70	\$0.40	\$0.00	\$0.00	\$0.00	\$0.10	\$0.00	\$34.51	\$46.17
More than 4000 hrs	100.00	\$25.90	\$7.00	\$3.70	\$0.40	\$0.00	\$0.00	\$0.00	\$0.10	\$0.00	\$37.10	\$50.05

Special Calculation Note : \$0.10 LECET is for Labor Management.

Ratio :

1 Journeymen to 1 Apprentice
4 Journeymen to 1 Apprentice

Jurisdiction (* denotes special jurisdictional note) :

CHAMPAIGN, CLARK, DARKE, GREENE,
LOGAN, MIAMI, MONTGOMERY, PREBLE

Special Jurisdictional Note :

Details :

Group 1

Building & Construction Laborer, Railroad Laborer, Asbestos & Hazardous Waste (Levels A,B,C, & D), Concrete Crew, Form Setter, Pipelayer, Bottom Man, Burner (Cutting Torch), Welder Helper, All Machine & Power Driven Tools, Sandblaster

Yardman-Landscaping, Sewer Jet, Waterperson, Tool Cage Laborer, Unloading Furniture & Fixtures, Final Clean-Up

Watchman, Residential Construction, Signal Men

Group 2

Mason Tender For Bricklayers, Flexcore, Firebrick Tender (Blast Furnaces, Soaking Pits, Stoves & Stacks), Plasterer Tenders & Lathers

Group 3
Tender Operator

Asbestos, Lead and Hazardous Material:

The removal, abatement or encapsulation of asbestos, lead and/or toxic and hazardous waste or materials is defined as all work included in the erection, moving servicing and dismantling of all enclosures, scaffolding, barricades, etc. and the operation of all tools and equipment (including generators, compressors and vacuums) normally used in the removal or abatement or asbestos, lead and toxic and hazardous waste or materials; the labeling, bagging, cartoning, crating or otherwise packaging of materials for disposal; as well as the clean-up of the work site and all other work incidental to the removal, abatement or encapsulation of asbestos, lead or toxic and hazardous waste materials.

Level A

Protective equipment is required when the area has been determined to contain extremely toxic contaminants or contaminants unknown but may be expected to be extremely toxic and/or immediately dangerous to life and health. This ensemble includes a fully encapsulated chemical suit, self contained breathing apparatus (SCBA) or airline fed respirator, and various types and numbers of boots and gloves.

Level B

Protective equipment includes a chemically resistant splash suit and a SCBA or airline respirator. This ensemble is required when the situation is very hazardous, such as oxygen deficient atmospheres, IDLH atmospheres, or confined space entries.

Level C

Protective equipment includes a protective suit and an air purifying respirator (APR) with the appropriate filter canisters.

Level D

To be worn only in established "safe zones" may consist of, from normal work clothes to normal skin protection such as gloves, face shields goggles, coveralls and occasionally respiratory protection.

Prevailing Wage Rate Skilled Crafts

Name of Union: Operating Engineers - Building Local 18 - Zone III

Change # : LCN01-2020fbLoc18zone3

Craft : Operating Engineer Effective Date : 05/14/2020 Last Posted : 05/14/2020

	BHR		Fringe Benefit Payments					Irrevocable Fund		Total PWR	Overtime Rate	
			H&W	Pension	App Tr.	Vac.	Annuity	Other	LECET (*)			MISC (*)
Classification												
Operator Class 1	\$38.24		\$8.51	\$6.00	\$0.85	\$0.00	\$0.00	\$0.09	\$0.00	\$0.00	\$53.69	\$72.81
Class 2	\$38.12		\$8.51	\$6.00	\$0.85	\$0.00	\$0.00	\$0.09	\$0.00	\$0.00	\$53.57	\$72.63
Class 3	\$37.08		\$8.51	\$6.00	\$0.85	\$0.00	\$0.00	\$0.09	\$0.00	\$0.00	\$52.53	\$71.07
Class 4	\$35.90		\$8.51	\$6.00	\$0.85	\$0.00	\$0.00	\$0.09	\$0.00	\$0.00	\$51.35	\$69.30
Class 5	\$30.44		\$8.51	\$6.00	\$0.85	\$0.00	\$0.00	\$0.09	\$0.00	\$0.00	\$45.89	\$61.11
Class 6	\$38.49		\$8.51	\$6.00	\$0.85	\$0.00	\$0.00	\$0.09	\$0.00	\$0.00	\$53.94	\$73.18
Class 7	\$38.74		\$8.51	\$6.00	\$0.85	\$0.00	\$0.00	\$0.09	\$0.00	\$0.00	\$54.19	\$73.56
Class 8	\$39.24		\$8.51	\$6.00	\$0.85	\$0.00	\$0.00	\$0.09	\$0.00	\$0.00	\$54.69	\$74.31
Class 9	\$39.49		\$8.51	\$6.00	\$0.85	\$0.00	\$0.00	\$0.09	\$0.00	\$0.00	\$54.94	\$74.68
Apprentice	Percent											
1st Year	50.00	\$19.12	\$8.51	\$6.00	\$0.85	\$0.00	\$0.00	\$0.09	\$0.00	\$0.00	\$34.57	\$44.13
2nd Year	60.00	\$22.94	\$8.51	\$6.00	\$0.85	\$0.00	\$0.00	\$0.09	\$0.00	\$0.00	\$38.39	\$49.87
3rd Year	70.00	\$26.77	\$8.51	\$6.00	\$0.85	\$0.00	\$0.00	\$0.09	\$0.00	\$0.00	\$42.22	\$55.60
4th Year	80.00	\$30.59	\$8.51	\$6.00	\$0.85	\$0.00	\$0.00	\$0.09	\$0.00	\$0.00	\$46.04	\$61.34
Field Mechanic Trainee												
1st Year	50.00	\$19.12	\$8.51	\$6.00	\$0.85	\$0.00	\$0.00	\$0.09	\$0.00	\$0.00	\$34.57	\$44.13
2nd Year	60.00	\$22.94	\$8.51	\$6.00	\$0.85	\$0.00	\$0.00	\$0.09	\$0.00	\$0.00	\$38.39	\$49.87
3rd Year	70.00	\$26.77	\$8.51	\$6.00	\$0.85	\$0.00	\$0.00	\$0.09	\$0.00	\$0.00	\$42.22	\$55.60
4th Year	80.00	\$30.59	\$8.51	\$6.00	\$0.85	\$0.00	\$0.00	\$0.09	\$0.00	\$0.00	\$46.04	\$61.34

Special Calculation Note : Other: Education & Safety \$0.09

Ratio :

For every (3) Operating Engineer Journeymen employed by the company there may be employed (1) Registered Apprentice or trainee Engineer through the referral when they are available. An apprenice, while employed as part of a crew per

Jurisdiction (* denotes special jurisdictional note) :

ADAMS, ALLEN, ASHLAND, ATHENS, AUGLAIZE, BELMONT, BROWN, BUTLER, CARROLL, CHAMPAIGN, CLARK, CLERMONT, CLINTON, COSHOCTON, CRAWFORD, DARKE, DEFIANCE,

Article VIII, paragraph 77, will not be subject to the apprenticeship ratios in this collective bargaining agreement

DELAWARE, FAIRFIELD, FAYETTE, FRANKLIN, FULTON, GALLIA, GREENE, GUERNSEY, HAMILTON, HANCOCK, HARDIN, HARRISON, HENRY, HIGHLAND, HOCKING, HOLMES, JACKSON, JEFFERSON, KNOX, LAWRENCE, LICKING, LOGAN, MADISON, MARION, MEIGS, MERCER, MIAMI, MONROE, MONTGOMERY, MORGAN, MORROW, MUSKINGUM, NOBLE, OTTAWA, PAULDING, PERRY, PICKAWAY, PIKE, PREBLE, PUTNAM, RICHLAND, ROSS, SANDUSKY, SCIOTO, SENECA, SHELBY, STARK, TUSCARAWAS, UNION, VAN WERT, VINTON, WARREN, WASHINGTON, WAYNE, WILLIAMS, WYANDOT

Special Jurisdictional Note :

Details :

**Apprentices will receive a 10% increase on top of the percentages listed above provided they are operating mobile equipment. Mechanic Trainees will receive 10% increase if required to have CDL

Class 1 - Barrier Moving Machine; Boiler Operators or Compressor Operators, when compressor or boiler is mounted on crane (Piggyback Operation); Boom Trucks (all types); Cableways Cherry Pickers; Combination - Concrete Mixers & Towers; All Concrete Pumps with Booms; Cranes (all types) Derricks (all types); Draglines Dredges (dipper, clam or suction) 3-man crew; Elevating Graders or Euclid Loaders; Floating Equipment; Gradalls; Helicopter Operators; hoisting building materials; Helicopter Winch Operators, Hoisting building materials; Hoes (All types); Hoists (with two or more drums in use); Hydraulic Gantry (lift system); Laser Finishing Machines; Lift Slab or Panel Jack Operators; Locomotives (all types); Maintenance Engineers (Mechanic and/or Welder); Mixers, paving (multiple drum); Mobile Concrete Pumps, with booms, Panelboards, (all types on site); Pile Drivers; Power Shovels; Prentice Loader; Rail Tamper (with automatic lifting and aligning device); Rotary Drills (all) used on caissons for foundations and sub-structure work; Side Booms; Slip Form Pavers; Straddle Carriers (Building Construction on site); Tug Boats. Horizontal Directional Drill, Rough Terrain Fork-lift with Winch/Hoist, Laser Screed, and Like equipment; Compact Cranes, track or rubber over 4,000 pound capacity, self-erecting cranes; stationary, track or truck (all configurations) bucket trench machines (over 24 " wide).

Class 2 - Asphalt Pavers; Bobcat-type and/or skid steer loader with hoe attachment greater than 7000 lbs. Bulldozers; CMI type Equipment; Endloaders; Hydro Milling Machine; Kolman-type Loaders (Dirt Loading); Lead Greasemen; Mucking Machines; Pettibone-Rail Equipment; Power Graders; Power Scoops; Power Scrapers; Push Cats; Vermeer Type Concrete Saw; All rotomills, grinders & planers of all types. Articulating/end dumps (minus \$4.00/hour from Class 2 rate)

Class 3 - A Frames; Air Compressors, Pressurizing Shafts or Tunnels; All Asphalt Rollers; Bobcat-type and/or skid steer loader with or without attachments; Boilers (15 lbs pressure and over); All concrete Pumps (without booms with 5 inch system); Fork Lifts (except masonry); Highway Drillers - all types (with integral power); Hoists (with one drum); House Elevators (except those automatic call button controlled); Man lifts; Mud Jacks; Pressure Grouting; Pump Operators (installing or operating

Well Points or other types of Dewatering Systems); Pumps (4 inches and over discharge); Railroad Tie Inserter/Remover; Rotator (Lime-Soil Stabilizer); Submersible Pumps (4 inches and over discharge); Switch & Tie Tampers (without lifting and aligning device); Trench Machines (24 inches and under); Utility Operators; Material hoist/elevators.

Class 4 - Ballast Re-locator; Backfillers and Tampers; Batch Plant Operators; Bar and Joint Installing Machines; Bull Floats; Burlap and Curing Machines; Clefplanes; Compressors, on building construction; Concrete Spreader; Conveyors, used for handling building materials; Concrete Mixers, one bag capacity (side loader); Concrete Mixers, capacity more than one bag; Crushers; Deck Hands; Drum Fireman (in Asphalt Plant); Farm type tractors pulling attachments; Finishing Machines; Form Trenchers; Generators: Guniting Machines; Hydro-Seeders; Pavement Breakers (hydraulic or cable); Post Drivers; Post Hole Diggers; Pressure Pumps (over 1/2 inch discharge); Road Widening Trenchers; Rollers (except asphalt); All Concrete pumps (without Boom with 4 inch or smaller systems); Self-Propelled Power Spreaders; Concrete Spreaders; Self-Propelled Sub-graders; Shotcrete Machines; Tire Repairmen; Tractors, pulling sheepfoot rollers or graders; VAC/ALLS; Vibratory Compactors, with integral power; Welder Operators.

Class 5 - Boilers (less than 15 lbs. pressure); Inboard/outboard Motor Boat Launches; Light Plant Operators; Masonry Fork Lifts; Oilers/Helpers; Power Driven Heaters (oil fired); Power Scrubbers; Power Sweepers; Pumps (under 4 inch discharge); Signalmen, Submersible Pumps (under 4 inch discharge). Directional Drill Locator and Allen Screed Concrete Paver. Fueling and greasing (Primary Operator with Specialized CDL Endorsement Add \$3.00/ hour), compact cranes; track or rubber under 4,000 pounds.

Class 6 - Master Mechanic

Class 7 - Boom & Jib 150 - 180 feet

Class 8 - Boom & Jib 180 - 249 feet

Class 9 - Boom & Jib 250 - or over

Prevailing Wage Rate Skilled Crafts

Name of Union: Operating Engineers - HevHwy Zone II

Change # : LCN01-2020fbLoc18hevhwyl

Craft : Operating Engineer Effective Date : 05/14/2020 Last Posted : 05/14/2020

	BHR		Fringe Benefit Payments					Irrevocable Fund		Total PWR	Overtime Rate	
			H&W	Pension	App Tr.	Vac.	Annuity	Other	LECET (*)			MISC (*)
Classification												
Operator Class 1	\$38.24		\$8.51	\$6.00	\$0.85	\$0.00	\$0.00	\$0.09	\$0.00	\$0.00	\$53.69	\$72.81
Class 2	\$38.12		\$8.51	\$6.00	\$0.85	\$0.00	\$0.00	\$0.09	\$0.00	\$0.00	\$53.57	\$72.63
Class 3	\$37.08		\$8.51	\$6.00	\$0.85	\$0.00	\$0.00	\$0.09	\$0.00	\$0.00	\$52.53	\$71.07
Class 4	\$35.90		\$8.51	\$6.00	\$0.85	\$0.00	\$0.00	\$0.09	\$0.00	\$0.00	\$51.35	\$69.30
Class 5	\$30.44		\$8.51	\$6.00	\$0.85	\$0.00	\$0.00	\$0.09	\$0.00	\$0.00	\$45.89	\$61.11
Class 6	\$38.49		\$8.51	\$6.00	\$0.85	\$0.00	\$0.00	\$0.09	\$0.00	\$0.00	\$53.94	\$73.18
Apprentice	Percent											
1st Year	50.00	\$19.12	\$8.51	\$6.00	\$0.85	\$0.00	\$0.00	\$0.09	\$0.00	\$0.00	\$34.57	\$44.13
2nd Year	60.00	\$22.94	\$8.51	\$6.00	\$0.85	\$0.00	\$0.00	\$0.09	\$0.00	\$0.00	\$38.39	\$49.87
3rd Year	70.00	\$26.77	\$8.51	\$6.00	\$0.85	\$0.00	\$0.00	\$0.09	\$0.00	\$0.00	\$42.22	\$55.60
4th Year	80.00	\$30.59	\$8.51	\$6.00	\$0.85	\$0.00	\$0.00	\$0.09	\$0.00	\$0.00	\$46.04	\$61.34
Field Mech Trainee Class 2												
1st year	49.85	\$19.06	\$8.51	\$6.00	\$0.85	\$0.00	\$0.00	\$0.09	\$0.00	\$0.00	\$34.51	\$44.04
2nd year	59.80	\$22.87	\$8.51	\$6.00	\$0.85	\$0.00	\$0.00	\$0.09	\$0.00	\$0.00	\$38.32	\$49.75
3rd year	69.77	\$26.68	\$8.51	\$6.00	\$0.85	\$0.00	\$0.00	\$0.09	\$0.00	\$0.00	\$42.13	\$55.47
4th year	79.75	\$30.50	\$8.51	\$6.00	\$0.85	\$0.00	\$0.00	\$0.09	\$0.00	\$0.00	\$45.95	\$61.19

Special Calculation Note : Other: Education & Safety Fund is \$0.09 per hour.

Ratio :

For every (3) Operating Engineer Journeymen employed by the company , there may be employed (1) Registered Apprentice or Trainee Engineer through the referral when they are available. An apprentice, while employed as part of a crew per Article VIII paragraph 65, will not be subject the apprenticeship ratios in this collective bargaining agreement.

Jurisdiction (* denotes special jurisdictional note) :

ADAMS, ALLEN, ASHLAND, ATHENS, AUGLAIZE, BELMONT, BROWN, BUTLER, CARROLL, CHAMPAIGN, CLARK, CLERMONT, CLINTON, COSHOCTON, CRAWFORD, DARKE, DEFIANCE, DELAWARE, FAIRFIELD, FAYETTE, FRANKLIN, FULTON, GALLIA, GREENE, GUERNSEY, HAMILTON, HANCOCK,

HARDIN, HARRISON, HENRY, HIGHLAND,
 HOCKING, HOLMES, HURON, JACKSON,
 JEFFERSON, KNOX, LAWRENCE, LICKING,
 LOGAN, LUCAS, MADISON, MARION,
 MEIGS, MERCER, MIAMI, MONROE,
 MONTGOMERY, MORGAN, MORROW,
 MUSKINGUM, NOBLE, OTTAWA,
 PAULDING, PERRY, PICKAWAY, PIKE,
 PREBLE, PUTNAM, RICHLAND, ROSS,
 SANDUSKY, SCIOTO, SENECA, SHELBY,
 STARK, TUSCARAWAS, UNION, VAN WERT,
 VINTON, WARREN, WASHINGTON, WAYNE,
 WILLIAMS, WOOD, WYANDOT

Special Jurisdictional Note :

Details :

**Apprentices will receive a 10% increase on top of the percentages listed above provided they are operating mobile equipment. Mechanic Trainees will receive 10% increase if they are required to have CDL.

Class 1 - Air Compressors on Steel Erection; Barrier Moving Machine; Boiler Operators, on Compressors or Generators, when mounted on a rig; Cableways, Combination Concrete mixers & Towers; Concrete Pumps; Concrete Plants (over 4 yd capacity); Cranes (all types, including Boom Trucks, Cherry Pickers); Derricks; Draglines, Dredgers (dipper, clam or suction); Elevating Graders or Euclid Loaders; Floating Equipment (all types); Gradalls, Helicopter Crew (Operator- hoist or winch); Hoes (all types); Hoisting Engines, on shaft or tunnel work; Hydraulic Gantry (lifting system); Industrial - Type Tractors; Jet Engine Dryers (D8 or D9), Diesel Tractors; Locomotives (standard gage); Maintenance Operators (class A); Mixers, paving (single or double drum); Mucking Machines; Multiple Scrapers; Piledriving Machines (all types); Power Shovels, Prentice Loader; Quad 9 (double pusher); Rail Tamper (with automatic lifting and aligning device); Refrigerating Machines (freezer operation); Side Booms; Slip Form Pavers; Tower Dericks; Tree Shredders; Truck Mounted Concrete Pumps; Tug Boats; Tunnel Machines and /or Mining Machines; Wheel Excavators. Rough Terrain Fork-lift with Winch/Hoist; Compact Cranes, track rubber over 4,000 pound capacity, self-erecting cranes; stationary, track or truck (all configurations) Bucket trench machines (over 24 inches wide).

Class 2 - Asphalt Pavers; Automatic Subgrade Machines, self-propelled (CMI-type); Bobcat-type and /or skid steer loader with hoe attachment greater than 7000 lbs.; Boring Machine Operators (more than 48 inches); Bulldozers; Endloaders; Hydro Milling Machine; Kolman-type Loaders (production type-dirt); Lead Greasemen; Maintenance Operators, Class B (Portage and Summit Counties only); Pettibone-Rail Equipment; Power Graders; Power Scrapers; Push Cats; Lighting and Traffic Signal Installation Equipment includes all groups or classifications; Trench Machines (24inch wide and under); Vermeer Type Concrete saw. Material Transfer Equipment (Shuttle buggy) Asphalt; All rotomills,grinders and planers of all types. Horizontal Directional Drill (Over 50,000 ft.lbs.thrust and over)

Class 3 - A-Frames; Air Compressors, on tunnel work (low Pressure); Asphalt Plant Engineers; Bobcat-type and/or skid steer loader with or without attachments; Power Boilers (15 lbs pressure and

over); Highway Drills (all types); Rollers, asphalt; Pump Operators (installing or operating well Points); Pumps (4 inch and over discharge); Railroad Tie Inserter/Remover; Rotator (lime-soil Stabilizer), Switch & Tie Tampers (without lifting and aligning device); Locomotives (narrow gage); Mixers, concrete (more than one bag capacity); Mixers, one bag capacity (side loader); Utilities Operators, (small equipment); Welding Machines; Material hoist/elevators. Articulating/straight bed end dumps if assigned (minus \$4.00 per hour).

Class 4 -Ballast Re-locator; Backfillers, Batch Plants; Bar and Joint Installing Machines; Boring Machine Operators (48 inch or less); Bull Floats; Burlap and Curing Machines; Concrete Plants (capacity 4 yd and under); Conveyors (highway); Concrete Saws (multiple); Crushers; Deckhands; Farm type tractors, with attachments (highway), except masonry; Finishing Machines; Firemen, Floating Equipment (all types); Fork Lifts (highway); Form Trenchers; Hydro Hammers; Hydro Seeders; Pavement Breakers; Plant Mixers; Post Drivers; Post Hole Diggers (power auger); Power Brush Burners; Power Form Handling Equipment; Road Widening Trenchers; Rollers (brick, grade, macadam); Self-Propelled Power Spreaders; Self-Propelled Sub-Graders; Tractors, pulling sheepsfoot rollers or graders; Steam Firemen; Vibratory Compactors, with integral power.

Class 5 - Compressors (portable, Sewer, Heavy and Highway); Generators; Inboard-Outboard Motor Boat Launches; Masonry Fork Lifts; Oilers/Helpers; Power Driven Heaters; Power Scrubbers; Power Sweepers; Pumps (under 4 inch discharge); Signalmen; Drum Fireman (in Asphalt Plant); Oil Heaters (Asphalt Plant); Tire Repairmen; VAC/ALLS; Fueling and greasing (Primary Operator with Specialized CDL Endorsement Add \$3.00/ hour), compact cranes: track or rubber under 4,000 pounds.

Class 6 - Master Mechanic

Prevailing Wage Rate Skilled Crafts

Name of Union: Painter Local 249

Change # : LCN01-2020fbLoc249

Craft : Painter Effective Date : 11/25/2020 Last Posted : 11/25/2020

	BHR		Fringe Benefit Payments					Irrevocable Fund		Total PWR	Overtime Rate
			H&W	Pension	App Tr.	Vac.	Annuity	Other	LECET (*)		
Classification											
Painter Brush Roll	\$24.07	\$5.67	\$5.65	\$0.28	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$35.67	\$47.71
Wall Covering Vinyl & Paper	\$24.07	\$5.67	\$5.65	\$0.28	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$35.67	\$47.71
Spray Commercial	\$24.07	\$5.67	\$5.65	\$0.28	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$35.67	\$47.71
Spray Industrial	\$24.07	\$5.67	\$5.65	\$0.28	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$35.67	\$47.71
Sandblasting, Steam Cleaning-Lead Abatement	\$24.82	\$5.67	\$5.65	\$0.28	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$36.42	\$48.83
Special Coating (Coal Tar) Spray Applied	\$25.57	\$5.67	\$5.65	\$0.28	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$37.17	\$49.96
Steeplejack Work	\$25.02	\$5.67	\$5.65	\$0.28	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$36.62	\$49.13
Elevated Tanks	\$27.71	\$5.67	\$5.65	\$0.28	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$39.31	\$53.17
Water Blasting	\$24.82	\$5.67	\$5.65	\$0.28	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$36.42	\$48.83
Apprentice	Percent										
30 Day Probationary	50.00	\$12.04	\$5.67	\$0.45	\$0.28	\$0.00	\$0.00	\$0.00	\$0.00	\$18.43	\$24.45
1st Year	55.00	\$13.24	\$5.67	\$0.45	\$0.28	\$0.00	\$0.00	\$0.00	\$0.00	\$19.64	\$26.26
2nd Year	65.00	\$15.65	\$5.67	\$0.45	\$0.28	\$0.00	\$0.00	\$0.00	\$0.00	\$22.05	\$29.87
3rd Year	75.00	\$18.05	\$5.67	\$0.45	\$0.28	\$0.00	\$0.00	\$0.00	\$0.00	\$24.45	\$33.48
4th Year	85.00	\$20.46	\$5.67	\$0.45	\$0.28	\$0.00	\$0.00	\$0.00	\$0.00	\$26.86	\$37.09

Special Calculation Note :

Ratio :

1 Journeymen to 1 Apprentice

Jurisdiction (* denotes special jurisdictional note) :

CLARK, DARKE, GREENE, MIAMI, MONTGOMERY, PREBLE

Special Jurisdictional Note :

Details :

Industrial work but not limited to:work done on industrial plants, repair garages, processing plants,storage tanks, warehouses, skeleton structures,bridges,whether new or old construction, office buildings in industrial sites and interior of shopping malls.

Prevailing Wage Rate Skilled Crafts

Name of Union: Painter Local 249 HevHwy

Change # : LCN01-2020fbLoc249

Craft : Painter Effective Date : 11/25/2020 Last Posted : 11/25/2020

	BHR		Fringe Benefit Payments					Irrevocable Fund		Total PWR	Overtime Rate	
			H&W	Pension	App Tr.	Vac.	Annuity	Other	LECET (*)			MISC (*)
Classification												
Painter Bridge Class 1	\$35.78		\$5.67	\$5.65	\$0.28	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$47.38	\$65.27
Bridge Painter, Rigger, Containment Builder, Spot Blaster Class 2	\$32.78		\$5.67	\$5.65	\$0.28	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$44.38	\$60.77
Equipment Operator/Field Mechanic, Grit Reclamation, Paint Mixer, Traffic Control, Boat Person, Driver Class 3	\$30.78		\$5.67	\$5.65	\$0.28	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$42.38	\$57.77
Concrete Sealing, Concrete Blasting/Power Washing/Etc. Class 4	\$28.78		\$5.67	\$5.65	\$0.28	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$40.38	\$54.77
Quality Control/Quality Assurance, Traffic safety, Competent Person Class 5	\$28.78		\$5.67	\$5.65	\$0.28	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$40.38	\$54.77
Apprentice	Percent											
30 day Probationary	50.00	\$17.89	\$5.67	\$0.45	\$0.28	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$24.29	\$33.24
1st Year	55.00	\$19.68	\$5.67	\$0.45	\$0.28	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$26.08	\$35.92
2nd Year	65.00	\$23.26	\$5.67	\$0.45	\$0.28	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$29.66	\$41.29
3rd Year	75.00	\$26.83	\$5.67	\$0.45	\$0.28	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$33.24	\$46.65
4th Year	85.00	\$30.41	\$5.67	\$0.45	\$0.28	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$36.81	\$52.02

Special Calculation Note :

Ratio :

1 Journeymen to 1 Apprentice

Jurisdiction (* denotes special jurisdictional note) :

CLARK, DARKE, GREENE, MIAMI, MONTGOMERY, PREBLE

Special Jurisdictional Note :

Details :

CLERMONT, CLINTON, COLUMBIANA,
COSHOCTON, CRAWFORD, CUYAHOGA,
DARKE, DEFIANCE, DELAWARE, ERIE,
FAIRFIELD, FAYETTE, FRANKLIN, FULTON,
GALLIA, GEAUGA, GREENE, GUERNSEY,
HAMILTON, HANCOCK, HARDIN,
HARRISON, HENRY, HIGHLAND, HOCKING,
HOLMES, HURON, JACKSON, JEFFERSON,
KNOX, LAKE, LAWRENCE, LICKING, LOGAN,
LORAIN, LUCAS, MADISON, MAHONING,
MARION, MEDINA, MEIGS, MERCER, MIAMI,
MONROE, MONTGOMERY, MORGAN,
MORROW, MUSKINGUM, NOBLE, OTTAWA,
PAULDING, PERRY, PICKAWAY, PIKE,
PORTAGE, PREBLE, PUTNAM, RICHLAND,
ROSS, SANDUSKY, SCIOTO, SENECA,
SHELBY, STARK, SUMMIT, TRUMBULL,
TUSCARAWAS, UNION, VAN WERT, VINTON,
WARREN, WASHINGTON, WAYNE,
WILLIAMS, WOOD, WYANDOT

Special Jurisdictional Note :

Details :

Top Helper: Shall perform the responsibilities of a Helper and be responsible for the setup, break down, safety and quality of the company's product.

Helper : Shall be responsible for performing tasks in refinishing, compliance with safety procedures, setting up and breaking down job sites, scaffolding and swing stages and preparing surfaces for refinishing including but not limited to, masking and stripping and cleaning, oxidizing, polishing and scratch removal on various surfaces

Class A Workers: Less than 1 Year of Service.

Class B Workers: More than 1 and less than 8 Years of Service.

Class C Workers: More than 8 Years of Service.

Metal Polisher Scope of Work: Polishing, buffing, stripping, coloring, lacquering, spraying, cleaning and maintenance of ornamental and architectural metals, iron, bronze, nickel, aluminum and stainless steel and in mental specialty work, various stone finishes, stone specialty work and any other work pertaining to the finishing of metal, stones, woods, and any window washing/cleaning done in conjunction with this work, using chemicals, solvents, coatings and hand applied lacquer thinner, removing scratches from mirror finished metals, burnishing of bronze, statuary finishes on exterior and interior surfaces and the use of all tools required to perform such work, including but not limited to polishes, spray equipment and scaffolding.

Swing State Rate: All work on scaffold 4 sections or higher, including any boom lifts and swing stage scaffolds including the rigging and derigging of hanging/suspended swing stage systems and rappelling/bolson chair work, ADD \$1.50 per hour.

Prevailing Wage Rate Skilled Crafts

Name of Union: Painter Local 639 Zone 2 Sign

Change # : LCN01-2016fbLoc639

Craft : Painter Effective Date : 08/03/2016 Last Posted : 08/03/2016

Classification	BHR	Fringe Benefit Payments						Irrevocable Fund		Total PWR	Overtime Rate
		H&W	Pension	App Tr.	Vac.	Annuity	Other	LECET (*)	MISC (*)		
Painter Sign Journeyman Tech/Team Leader Class A	\$21.25	\$1.33	\$0.14	\$0.00	\$0.00	\$0.00	\$0.57	\$0.00	\$0.00	\$23.29	\$33.92
Painter Sign Journeyman Tech/Team Leader Class B	\$21.25	\$1.33	\$0.14	\$0.00	\$0.41	\$0.00	\$0.57	\$0.00	\$0.00	\$23.70	\$34.32
Painter Sign Journeyman Tech/Team Leader Class C	\$21.25	\$1.33	\$0.14	\$0.00	\$0.82	\$0.00	\$0.57	\$0.00	\$0.00	\$24.11	\$34.74
Painter Sign Journeyman Tech/Team Leader Class D	\$21.25	\$1.33	\$0.14	\$0.00	\$1.23	\$0.00	\$0.57	\$0.00	\$0.00	\$24.52	\$35.14
Sign Journeyman Class A	\$20.98	\$1.33	\$0.14	\$0.00	\$0.00	\$0.00	\$0.56	\$0.00	\$0.00	\$23.01	\$33.50
Sign Journeyman Class B	\$20.98	\$1.33	\$0.14	\$0.00	\$0.40	\$0.00	\$0.56	\$0.00	\$0.00	\$23.41	\$33.90
Sign Journeyman Class C	\$20.98	\$1.33	\$0.14	\$0.00	\$0.81	\$0.00	\$0.56	\$0.00	\$0.00	\$23.82	\$34.31
Sign Journeyman Class D	\$20.98	\$1.33	\$0.14	\$0.00	\$1.21	\$0.00	\$0.56	\$0.00	\$0.00	\$24.22	\$34.71
Tech Sign Fabrication/ Erector Class A	\$15.90	\$1.33	\$0.14	\$0.00	\$0.00	\$0.00	\$0.43	\$0.00	\$0.00	\$17.80	\$25.75

Prevailing Wage Rate Skilled Crafts

Name of Union: Plasterer Local 132 (Dayton)

Change # : LCN01-2020fbLoc132

Craft : Plaster Effective Date : 07/30/2020 Last Posted : 07/30/2020

	BHR		Fringe Benefit Payments					Irrevocable Fund		Total PWR	Overtime Rate	
			H&W	Pension	App Tr.	Vac.	Annuity	Other	LECET (*)	MISC (*)		
Classification												
Plasterer	\$24.00		\$7.40	\$7.15	\$0.70	\$0.00	\$2.70	\$0.00	\$0.00	\$0.00	\$41.95	\$53.95
Apprentice	Percent											
1st 6 months	60.00	\$14.40	\$7.40	\$7.15	\$0.70	\$0.00	\$2.70	\$0.00	\$0.00	\$0.00	\$32.35	\$39.55
2nd 6 months	65.00	\$15.60	\$7.40	\$7.15	\$0.70	\$0.00	\$2.70	\$0.00	\$0.00	\$0.00	\$33.55	\$41.35
3rd 6 months	70.00	\$16.80	\$7.40	\$7.15	\$0.70	\$0.00	\$2.70	\$0.00	\$0.00	\$0.00	\$34.75	\$43.15
4th 6 months	75.00	\$18.00	\$7.40	\$7.15	\$0.70	\$0.00	\$2.70	\$0.00	\$0.00	\$0.00	\$35.95	\$44.95
5th 6 months	80.00	\$19.20	\$7.40	\$7.15	\$0.70	\$0.00	\$2.70	\$0.00	\$0.00	\$0.00	\$37.15	\$46.75
6th 6 months	85.00	\$20.40	\$7.40	\$7.15	\$0.70	\$0.00	\$2.70	\$0.00	\$0.00	\$0.00	\$38.35	\$48.55
7th 6 months	90.00	\$21.60	\$7.40	\$7.15	\$0.70	\$0.00	\$2.70	\$0.00	\$0.00	\$0.00	\$39.55	\$50.35
8th 6 months	95.00	\$22.80	\$7.40	\$7.15	\$0.70	\$0.00	\$2.70	\$0.00	\$0.00	\$0.00	\$40.75	\$52.15

Special Calculation Note : No special calculations for this skilled craft wage rate are required at this time.

Ratio :

3 Journeymen to 1 Apprentice

Jurisdiction (* denotes special jurisdictional note) :

CHAMPAIGN, CLARK, CLINTON, DARKE, GREENE, MIAMI, MONTGOMERY, PREBLE, SHELBY

Special Jurisdictional Note :

Details :

OTHER IS:Industry Fund

Prevailing Wage Rate Skilled Crafts

Name of Union: Plumber Pipefitter Local 162

Change # : OCRO1-2020fbLoc162

Craft : Plumber/Pipefitter Effective Date : 06/18/2020 Last Posted : 06/18/2020

	BHR		Fringe Benefit Payments					Irrevocable Fund		Total PWR	Overtime Rate	
			H&W	Pension	App Tr.	Vac.	Annuity	Other	LECET (*)	MISC (*)		
Classification												
Plumber Pipefitter	\$32.25		\$10.40	\$10.62	\$0.90	\$0.00	\$3.35	\$0.72	\$0.00	\$0.00	\$58.24	\$74.36
Apprentice Indentured AFTER 6/1/2002	Percent											
1st Year	50.00	\$16.12	\$10.40	\$3.19	\$0.90	\$0.00	\$0.00	\$0.72	\$0.00	\$0.00	\$31.33	\$39.40
2nd Year	55.00	\$17.74	\$10.40	\$4.25	\$0.90	\$0.00	\$1.34	\$0.72	\$0.00	\$0.00	\$35.35	\$44.22
3rd Year	60.00	\$19.35	\$10.40	\$6.37	\$0.90	\$0.00	\$2.01	\$0.72	\$0.00	\$0.00	\$39.75	\$49.42
4th Year	70.00	\$22.57	\$10.40	\$8.50	\$0.90	\$0.00	\$2.68	\$0.72	\$0.00	\$0.00	\$45.78	\$57.06
5th Year	80.00	\$25.80	\$10.40	\$10.62	\$0.90	\$0.00	\$3.35	\$0.72	\$0.00	\$0.00	\$51.79	\$64.69

Special Calculation Note : Other is for Training & Promotion Fund.

Ratio :

- 1 Journeyman to 1 Apprentice
- 2 - 4 Journeymen to 2 Apprentices
- 5 - 7 Journeymen to 3 Apprentices
- 8 - 10 Journeymen to 4 Apprentices

Jurisdiction (* denotes special jurisdictional note) :

CHAMPAIGN, CLARK, CLINTON, DARKE,
FAYETTE, GREENE, MIAMI,
MONTGOMERY, PREBLE

Special Jurisdictional Note :

Details :

Wage rate covers: all plumbing, pipefitting, heating, refrigeration and air conditioning work.

Prevailing Wage Rate Skilled Crafts

Name of Union: Roofer Local 75

Change # : LCN01-2020fbLoc75

Craft : Roofer Effective Date : 06/04/2020 Last Posted : 06/04/2020

	BHR		Fringe Benefit Payments					Irrevocable Fund		Total PWR	Overtime Rate	
			H&W	Pension	App Tr.	Vac.	Annuity	Other	LECET (*)	MISC (*)		
Classification												
Roofer	\$24.38		\$8.28	\$8.48	\$0.66	\$0.00	\$0.00	\$1.30	\$0.00	\$0.00	\$43.10	\$55.29
Slate and Tile	\$24.60		\$8.28	\$8.48	\$0.66	\$0.00	\$0.00	\$1.30	\$0.00	\$0.00	\$43.32	\$55.62
Apprentice												
	Percent											
1st term 1000 hrs	50.00	\$12.19	\$2.50	\$0.50	\$0.66	\$0.00	\$0.00	\$1.30	\$0.00	\$0.00	\$17.15	\$23.25
2nd term 1000 hrs	55.00	\$13.41	\$8.28	\$1.27	\$0.66	\$0.00	\$0.00	\$1.30	\$0.00	\$0.00	\$24.92	\$31.62
3rd term 1000 hrs	60.00	\$14.63	\$8.28	\$2.12	\$0.66	\$0.00	\$0.00	\$1.30	\$0.00	\$0.00	\$26.99	\$34.30
4th term 1000 hrs	70.00	\$17.07	\$8.28	\$2.97	\$0.66	\$0.00	\$0.00	\$1.30	\$0.00	\$0.00	\$30.28	\$38.81
5th term 1000 hrs	80.00	\$19.50	\$8.28	\$3.82	\$0.66	\$0.00	\$0.00	\$1.30	\$0.00	\$0.00	\$33.56	\$43.32
Tradesman	79.00	\$19.26	\$5.00	\$1.53	\$0.66	\$0.00	\$0.00	\$1.30	\$0.00	\$0.00	\$27.75	\$37.38

Special Calculation Note : Other is for National Roofing Industry Pension Plan.

Ratio :

3 Journeymen to 2 Apprentices

Jurisdiction (* denotes special jurisdictional note) :

ALLEN, AUGLAIZE, CLARK, CLINTON,
DARKE, GREENE, MERCER, MIAMI,
MONTGOMERY, PREBLE, SHELBY, VAN
WERT

Special Jurisdictional Note :

Details :

Prevailing Wage Rate Skilled Crafts

Name of Union: Sheet Metal Local 24 (Dayton)

Change # : LCR02-2019fbLoc24(Day)

Craft : Sheet Metal Worker Effective Date : 06/19/2019 Last Posted : 06/19/2019

	BHR		Fringe Benefit Payments					Irrevocable Fund		Total PWR	Overtime Rate	
			H&W	Pension	App Tr.	Vac.	Annuity	Other	LECET (*)			MISC (*)
Classification												
Sheet Metal Worker	\$27.72		\$8.52	\$14.46	\$0.85	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$51.55	\$65.41
Apprentice	Percent											
Apprentice												
5th Year B	80.00	\$22.18	\$8.26	\$11.56	\$0.85	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$42.85	\$53.93
5th Year A	75.00	\$20.79	\$8.20	\$10.85	\$0.85	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$40.69	\$51.09
4th Year B	70.00	\$19.40	\$8.13	\$10.13	\$0.85	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$38.51	\$48.22
4th Year A	65.00	\$18.02	\$8.07	\$9.40	\$0.85	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$36.34	\$45.35
3rd year B	60.00	\$16.63	\$8.01	\$8.68	\$0.85	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$34.17	\$42.49
3rd Year A	55.00	\$15.25	\$7.94	\$7.95	\$0.85	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$31.99	\$39.61
2 Year B	53.78	\$14.91	\$7.90	\$7.02	\$0.85	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$30.68	\$38.13
2 Year A	52.69	\$14.61	\$7.88	\$6.49	\$0.85	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$29.83	\$37.13
Probationary 1 Year	51.13	\$14.17	\$7.85	\$5.87	\$0.85	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$28.74	\$35.83

Special Calculation Note : No special calculations for this skilled craft wage rate are required at this time.

Ratio :

1 Journeyman to 1 Apprentice then,
1 Apprentice for every 2 Journeymen thereafter

Jurisdiction (* denotes special jurisdictional note) :

ALLEN, AUGLAIZE, BUTLER, CHAMPAIGN,
CLARK, CLINTON, DARKE, GREENE,
HARDIN, LOGAN, MERCER, MIAMI,
MONTGOMERY, PREBLE, SHELBY, VAN
WERT, WARREN, WYANDOT

Special Jurisdictional Note :

Details :

Prevailing Wage Rate Skilled Crafts

Name of Union: Sprinkler Fitter Local 669

Change # : LCN01-2021fbLoc669

Craft : Sprinkler Fitter Effective Date : 04/01/2021 Last Posted : 03/31/2021

	BHR		Fringe Benefit Payments					Irrevocable Fund		Total PWR	Overtime Rate
			H&W	Pension	App Tr.	Vac.	Annuity	Other	LECET (*)		
Classification											
Sprinkler Fitter	\$41.87	\$10.55	\$7.00	\$0.52	\$0.00	\$5.12	\$0.10	\$0.00	\$0.00	\$65.16	\$86.09
Apprentice Indentured after April 1, 2013	Percent										
CILASS 1	45.00	\$18.84	\$7.75	\$0.00	\$0.52	\$0.00	\$0.00	\$0.10	\$0.00	\$27.21	\$36.63
CLASS 2	50.00	\$20.93	\$7.75	\$0.00	\$0.52	\$0.00	\$0.00	\$0.10	\$0.00	\$29.30	\$39.77
CLASS 3	54.40	\$22.78	\$10.55	\$7.00	\$0.52	\$0.00	\$1.15	\$0.10	\$0.00	\$42.10	\$53.49
CLASS 4	59.40	\$24.87	\$10.55	\$7.00	\$0.52	\$0.00	\$1.15	\$0.10	\$0.00	\$44.19	\$56.63
CLASS 5	64.42	\$26.97	\$10.55	\$7.00	\$0.52	\$0.00	\$1.40	\$0.10	\$0.00	\$46.54	\$60.03
CLASS 6	69.40	\$29.06	\$10.55	\$7.00	\$0.52	\$0.00	\$1.40	\$0.10	\$0.00	\$48.63	\$63.16
CLASS 7	74.40	\$31.15	\$10.55	\$7.00	\$0.52	\$0.00	\$1.40	\$0.10	\$0.00	\$50.72	\$66.30
CLASS 8	79.42	\$33.25	\$10.55	\$7.00	\$0.52	\$0.00	\$1.40	\$0.10	\$0.00	\$52.82	\$69.45
CLASS 9	84.40	\$35.34	\$10.55	\$7.00	\$0.52	\$0.00	\$1.40	\$0.10	\$0.00	\$54.91	\$72.58
CLASS 10	89.40	\$37.43	\$10.55	\$7.00	\$0.52	\$0.00	\$1.40	\$0.10	\$0.00	\$57.00	\$75.72

Special Calculation Note : \$0.10 for Other is National Fire Sprinkler Association

Ratio :

1 Journeyman to 1 Apprentice

Jurisdiction (* denotes special jurisdictional note) :

ADAMS, ALLEN, ASHLAND, ASHTABULA, ATHENS, AUGLAIZE, BELMONT, BROWN, BUTLER, CARROLL, CHAMPAIGN, CLARK, CLERMONT, CLINTON, COLUMBIANA, COSHOCTON, CRAWFORD, DARKE, DEFIANCE, DELAWARE, ERIE, FAIRFIELD, FAYETTE, FRANKLIN, FULTON, GALLIA, GREENE, GUERNSEY, HAMILTON, HANCOCK, HARDIN, HARRISON, HENRY, HIGHLAND, HOCKING, HOLMES, HURON, JACKSON, JEFFERSON, KNOX, LAWRENCE, LICKING, LOGAN, LUCAS, MADISON,

MAHONING, MARION, MEDINA, MEIGS,
MERCER, MIAMI, MONROE,
MONTGOMERY, MORGAN, MORROW,
MUSKINGUM, NOBLE, OTTAWA,
PAULDING, PERRY, PICKAWAY, PIKE,
PORTAGE, PREBLE, PUTNAM, RICHLAND,
ROSS, SANDUSKY, SCIOTO, SENECA,
SHELBY, STARK, SUMMIT, TRUMBULL,
TUSCARAWAS, UNION, VAN WERT,
VINTON, WARREN, WASHINGTON, WAYNE,
WILLIAMS, WOOD, WYANDOT

Special Jurisdictional Note :

Details :

Sprinkler Fitter work shall consist of the installation, dismantling, maintenance, repairs, adjustments, and corrections of all fire protection and fire control systems including the unloading, handling by hand, power equipment and installation of all piping or tubing, appurtenances and equipment pertaining thereto, including both overhead and underground water mains, fire hydrants and hydrant mains, standpipes and hose connections to sprinkler systems used in connection with sprinkler and alarm systems. Also all tanks and pumps connected thereto, also included shall be CO-2 and Cardox Systems, Dry Chemical Systems, Foam Systems and all other fire protection systems.

Prevailing Wage Rate Skilled Crafts

**Name of Union: Truck Driver Bldg & HevHwy Class 1
Locals 20,40,92,92b,100,175,284,438,377,637,908,957**

Change # : OCRO1-2019fbBldgHevHwy

Craft : Truck Driver Effective Date : 09/11/2019 Last Posted : 09/11/2019

	BHR		Fringe Benefit Payments					Irrevocable Fund		Total PWR	Overtime Rate	
			H&W	Pension	App Tr.	Vac.	Annuity	Other	LECET (*)			MISC (*)
Classification												
Truck Driver CLASS 1 4 wheel service, dump, and batch trucks, Oil Distributor - Asphalt Distributor-Tandems	\$28.04		\$7.00	\$7.90	\$0.20	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$43.14	\$57.16
Apprentice	Percent											
First 6 months	80.00	\$22.43	\$7.00	\$7.90	\$0.20	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$37.53	\$48.75
7-12 months	85.00	\$23.83	\$7.00	\$7.90	\$0.20	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$38.93	\$50.85
13-18 months	90.00	\$25.24	\$7.00	\$7.90	\$0.20	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$40.34	\$52.95
19-24 months	95.00	\$26.64	\$7.00	\$7.90	\$0.20	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$41.74	\$55.06
25-30 months	100.00	\$28.04	\$7.00	\$7.90	\$0.20	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$43.14	\$57.16

Special Calculation Note : No special calculations for this skilled craft wage rate are required at this time.

Ratio :

3 Journeymen to 1 Apprentice

Jurisdiction (* denotes special jurisdictional note) :

ADAMS, ALLEN, ASHLAND, ASHTABULA, ATHENS, AUGLAIZE, BELMONT, BROWN, BUTLER, CARROLL, CHAMPAIGN, CLARK, CLERMONT, CLINTON, COLUMBIANA, COSHOCTON, CRAWFORD, DARKE,

DEFIANCE, DELAWARE, ERIE, FAIRFIELD,
FAYETTE, FRANKLIN, FULTON, GALLIA,
GREENE, GUERNSEY, HAMILTON,
HANCOCK, HARDIN, HARRISON, HENRY,
HIGHLAND, HOCKING, HOLMES, HURON,
JACKSON, JEFFERSON, KNOX, LAWRENCE,
LICKING, LOGAN, LORAIN, LUCAS,
MADISON, MAHONING, MARION, MEDINA,
MEIGS, MERCER, MIAMI, MONROE,
MONTGOMERY, MORGAN, MORROW,
MUSKINGUM, NOBLE, OTTAWA,
PAULDING, PERRY, PICKAWAY, PIKE,
PORTAGE, PREBLE, PUTNAM, RICHLAND,
ROSS, SANDUSKY, SCIOTO, SENECA,
SHELBY, STARK, SUMMIT, TRUMBULL,
TUSCARAWAS, UNION, VAN WERT,
VINTON, WARREN, WASHINGTON, WAYNE,
WILLIAMS, WOOD, WYANDOT

Special Jurisdictional Note :

Details :

** Asphalt - Oil spray bar man when operating from cab shall receive \$0.20 cents per hour above their Basic Hourly Rate.

Prevailing Wage Rate Skilled Crafts

**Name of Union: Truck Driver Bldg & HevHwy Class 2
Locals 20,40,92,92b,100,175,284,438,377,637,908,957**

Change # : LCRO1-2019-fbBldgHevHwy

Craft : Truck Driver Effective Date : 10/16/2019 Last Posted : 10/16/2019

Classification	BHR	Fringe Benefit Payments					Irrevocable Fund	Total PWR	Overtime Rate	
		H&W Pension	App Tr.	Vac.	Annuity	Other	LECET (*)	MISC (*)		
Truck Driver CLASS 2	\$28.46	\$7.00	\$7.90	\$0.20	\$0.00	\$0.00	\$0.00	\$0.00	\$43.56	\$57.79
Tractor										
Trailer-Semi										
Tractor										
Trucks-Pole										
Trailers-Ready Mix										
Trucks-Fuel										
Trucks-Asphalt-Oil										
Spray bar										
men- 5 Axle										
& Over -Belly										
Dumps-End										
Dumps-Articulated										
Dump Trucks-Low boys-										
Heavy duty										
Equipment (irrespective of load carried) when used exclusively for transportation-										
Truck Mechanics (when needed)										
Apprentice	Percent									
First 6 months	80.00	\$22.77	\$7.00	\$7.90	\$0.20	\$0.00	\$0.00	\$0.00	\$37.87	\$49.25
7-12 months	85.00	\$24.19	\$7.00	\$7.90	\$0.20	\$0.00	\$0.00	\$0.00	\$39.29	\$51.39
13-18 months	90.00	\$25.61	\$7.00	\$7.90	\$0.20	\$0.00	\$0.00	\$0.00	\$40.71	\$53.52

19-24 months	95.00	\$27.04	\$7.00	\$7.90	\$0.20	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$42.14	\$55.66
25-30 months	100.00	\$28.46	\$7.00	\$7.90	\$0.20	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$43.56	\$57.79

Special Calculation Note : No special calculations for this skilled craft wage rate are required at this time.

Ratio :

3 Journeymen to 1 Apprentice

Jurisdiction (* denotes special jurisdictional note) :

ADAMS, ALLEN, ASHLAND, ASHTABULA, ATHENS, AUGLAIZE, BELMONT, BROWN, BUTLER, CARROLL, CHAMPAIGN, CLARK, CLERMONT, CLINTON, COLUMBIANA, COSHOCTON, CRAWFORD, DARKE, DEFIANCE, DELAWARE, ERIE, FAIRFIELD, FAYETTE, FRANKLIN, FULTON, GALLIA, GREENE, GUERNSEY, HAMILTON, HANCOCK, HARDIN, HARRISON, HENRY, HIGHLAND, HOCKING, HOLMES, HURON, JACKSON, JEFFERSON, KNOX, LAWRENCE, LICKING, LOGAN, LORAIN, LUCAS, MADISON, MAHONING, MARION, MEDINA, MEIGS, MERCER, MIAMI, MONROE, MONTGOMERY, MORGAN, MORROW, MUSKINGUM, NOBLE, OTTAWA, PAULDING, PERRY, PICKAWAY, PIKE, PORTAGE, PREBLE, PUTNAM, RICHLAND, ROSS, SANDUSKY, SCIOTO, SENECA, SHELBY, STARK, SUMMIT, TRUMBULL, TUSCARAWAS, UNION, VAN WERT, VINTON, WARREN, WASHINGTON, WAYNE, WILLIAMS, WOOD, WYANDOT

Special Jurisdictional Note :

Details :

** Asphalt - Oil spray bar man when operating from cab shall receive \$0.20 cents per hour above their Basic Hourly Rate.

ATTACHMENT B

Substitutions Form

Project Manual:

Rosewood Arts Center Exterior Renovation for



2655 Olson Drive
Kettering, Ohio 45420

OWNER

City of Kettering
3600 Shroyer Road
Kettering, Ohio 45420

Bidding and Permit Set

DATE

APRIL 30, 2021

Division 00 - 33

ARCHITECT

LWC Incorporated
434 East First Street
Dayton, Ohio 45402
Phone: (937) 223-6500



CIVIL ENGINEER

Burkhardt Engineering
28 N. Cherry Street
Germantown, Ohio 45327
Phone: (937) 388-0060



STRUCTURAL
ENGINEER

Shell + Meyer Associates
2202 S Patterson Blvd
Dayton, Ohio 45409
Phone: (937) 298-4631



MECH/ ELEC
ENGINEER

CMTA
1650 Lake Shore Drive, Suite 380
Columbus, OH 43204
Phone: (937) 776-3608



**INDEX FOR
CITY OF KETTERING
ROSEWOOD ARTS CENTER
EXTERIOR RENOVATION**

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087111	Door Hardware
087113	Automatic Door Operators
088000	Glazing

Division 09 – Finishes

099113	Exterior Painting
099726	Silicate Coatings

Division 10 – Not Used

Division 11- Not Used

Division 12 – Furnishings

124813	Entrance Floor Tile
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Division13 – Not Used

Division 14 – Not Used

Division 21 – Fire Suppression - Not Used

Division 22 – Plumbing - Not Used

Division 23 –Heating, Ventilation, and Air Conditioning - Not Used

Division 26 – Electrical

260501	General Provisions - Electrical
260502	Scope of the Electrical Work
260503	Shop Drawings, Etc.
260504	Sleeving, Cutting, Patching & Repairing for Electrical Systems
260505	Excavation, Trenching, Backfilling & Grading
260506	Demolition, Restoration & Salvage
260508	Coordination Among Trades and System Interfacing
260510	Description of Electrical System
260519	Low-Voltage Electrical Power, Conductors, Cables, Splicing Devices and Connectors
260526	Grounding and Bonding for Electrical Systems
260529	Hangers and Supports for Electrical Systems
260533	Raceways & Fittings for Electrical Systems
260535	Cabinets, Outlet Boxes & Pull Boxes for Electrical Systems
260543	Underground Ducts and Raceways for Electrical Systems
260553	Identifications for Electrical Systems
260573	Electrical Studies
262413	Low-Voltage Switchboard
262726	Wiring Devices and Plates
262816	Enclosed Switches and Circuit Breakers
265113	Interior Lighting

Division 27 – Communications - Not Used

Division 28 – Electronic Safety and Security - Not Used

Division 31 – Earthwork - Not Used

Division 32 – Exterior Improvements - Not Used

Division 33 – Utilities- Not Used

DIVISION

O

BIDDING AND CONTRACT REQUIREMENTS



SUBSTITUTION REQUEST

(During the Bidding/Negotiating Stage)

Project: _____ Substitution Request Number: _____

From: _____

To: _____ Date: _____

A/E Project Number: _____

Re: _____ Contract For: _____

Specification Title: _____ Description: _____

Section: _____ Page: _____ Article/Paragraph: _____

Proposed Substitution: _____

Manufacturer: _____ Address: _____ Phone: _____

Trade Name: I _____ Model No.: _____

Attached data includes product description, specifications, drawings, photographs, and performance and test data adequate for evaluation of the request; applicable portions of the data are clearly identified.

Attached data also includes a description of changes to the Contract Documents that the proposed substitution will require for its proper installation.

The Undersigned certifies:

- Proposed substitution has been fully investigated and determined to be equal or superior in all respects to specified product.
- Same warranty will be furnished for proposed substitution as for specified product.
- Same maintenance service and source of replacement parts, as applicable, is available.
- Proposed substitution will have no adverse effect on other trades and will not affect or delay progress schedule.
- Proposed substitution does not affect dimensions and functional clearances.
- Payment will be made for changes to building design, including A/E design, detailing, and construction costs caused by the substitution.

Submitted by: _____

Signed by: _____

Firm: _____

Address: _____

Telephone: _____

A/E's REVIEW AND ACTION

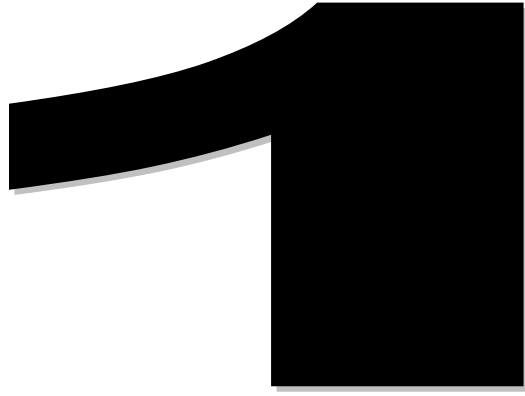
- Substitution approved - Make submittals in accordance with Specification Section 01 25 00 Substitution Procedures.
- Substitution approved as noted - Make submittals in accordance with Specification Section 01 25 00 Substitution Procedures.
- Substitution rejected - Use specified materials.
- Substitution Request received too late - Use specified materials.

Signed by: _____

Date: _____

Supporting Data Attached: Drawings Product Data Samples Tests Reports _____

DIVISION



GENERAL CONDITIONS

SECTION 011000 - SUMMARY

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:
 - 1. Project information.
 - 2. Work covered by Contract Documents.
 - 3. Work performed by Owner.
 - 4. Work under Owner's separate contracts.
 - 5. Contractor's use of site and premises.
 - 6. Coordination with occupants.
 - 7. Work restrictions.
 - 8. Specification and Drawing conventions.

1.3 DEFINITIONS

- A. Work Package: A group of specifications, drawings, and schedules prepared by the design team to describe a portion of the Project Work for pricing, permitting, and construction.

1.4 PROJECT INFORMATION

- A. Project Identification: Kettering Arts Center Renovation
 - 1. Project Location: 2655 Olson Drive, Kettering OH 45420
- B. Owner: City of Kettering
 - 1. Owner's Representative: Rob Baker, Assistant Public Services Director.
Robert.Baker@ketteringoh.org
- C. Architect: LWC
 - 1. Architect's Representative: William Kaly, AIA Senior Associate. wkaly@lwcinspires.com

D. Architect's Consultants: Architect has retained the following design professionals, who have prepared designated portions of the Contract Documents:

1. Mechanical, Electrical, Plumbing and Fire Protection Engineering
 - a. CMTA.
 - 1) Representative: John Harpest, LC, BD+C jharpest@cmta.com
2. Structural Engineering
 - a. Shell + Meyer
 - 1) Ben Van De Weghe ben.vandeweghe@shellandmeyer.com
3. Civil Engineering
 - a. Burkhardt Engineering
 - 1) Jonathan Burkhardt, President/CEO jdburkhardt@burkhardtinc.com

E. Project Coordinator for Multiple Contracts: Owner shall serve as Project coordinator.

1.5 WORK COVERED BY CONTRACT DOCUMENTS

A. The Work of Project is defined by the Contract Documents and includes, but is not limited to, the following:

1. The Project shall entail a replacement of the existing roofing system on the building. Selective demolition of roof elements is required and while retaining portions of the existing roof system are stipulated. A new exterior entrance vestibule will be constructed and existing exterior windows and doors shall be replaced as part of the project along with a full electrical service upgrade included with other Work indicated in the Contract Documents.

B. Type of Contract:

1. Project will be constructed under a single prime contract, either limited to the scope of these documents or included with the scope of the Phase 1, Interior Renovation which will be completed concurrently. Refer to the Instructions to Bidders for more information.

1.6 WORK PERFORMED BY OWNER

A. Cooperate fully with Owner, so work may be carried out smoothly, without interfering with or delaying Work under this Contract or work by Owner. Coordinate the Work of this Contract with work performed by Owner.

B. Subsequent Work: Owner will perform the following additional work at site after Substantial Completion. Completion of that work will depend on successful completion of preparatory Work under this Contract.

1. Installation of Furniture, Fixtures and Equipment outside of this Contract.
2. Renovation Projects, Phases 2 and 3

1.7 WORK UNDER OWNER'S SEPARATE CONTRACTS

- A. Work with Separate Contractors: Cooperate fully with Owner's separate contractors, so work on those contracts may be carried out smoothly, without interfering with or delaying Work under this Contract or other contracts. Coordinate the Work of this Contract with work performed under Owner's separate contracts.
- B. Concurrent Work: Owner will award a separate contract for the following construction operations at Project site. Those operations will be conducted simultaneously with Work under this Contract.
 - 1. Phase 1 Interior Renovation project addressing interior renovations to a portion of the existing building and relocation of interior programming spaces.
 - a. Note: This package may be combined with the Phase 0 Exterior Envelope Restoration Project pending the results of the Bid. Refer to the Instructions to Bidders for more information.
- C. Subsequent Work: Owner will award separate contracts for the following additional work to be performed at this site following Substantial Completion. Completion of that work will depend on successful completion of preparatory Work under this Contract.
 - 1. Phase 2 Interior Renovation
 - 2. Phase 3 Interior Renovation

1.8 CONTRACTOR'S USE OF SITE AND PREMISES

- A. Restricted Use of Site: Contractor shall have limited use of Project site for construction operations as indicated on Drawings by the Contract limits and as indicated by requirements of this Section.
- B. Limits on Use of Site: Limit use of Project site to Work in areas indicated. Do not disturb portions of Project site beyond areas in which the Work is indicated.
 - 1. Limits on Use of Site: Confine construction operations to areas indicated on the Construction Documents where work is permitted.
 - 2. Driveways, Walkways and Entrances: Keep driveways and entrances serving premises clear and available to Owner, Owner's employees, and emergency vehicles at all times. Do not use these areas for parking or for storage of materials.
 - a. Schedule deliveries to minimize use of driveways and entrances by construction operations.
 - b. Schedule deliveries to minimize space and time requirements for storage of materials and equipment on-site.
- C. Condition of Existing Building: Maintain portions of existing building affected by construction operations in a weathertight condition throughout construction period. Repair damage caused by construction operations.
- D. Condition of Existing Grounds: Maintain portions of existing grounds, landscaping, and hardscaping affected by construction operations throughout construction period. Repair damage caused by construction operations.

1.9 COORDINATION WITH OCCUPANTS

- A. Partial Owner Occupancy: Owner will occupy the premises during entire construction period, with the exception of areas under construction. Cooperate with Owner during construction operations to minimize conflicts and facilitate Owner usage. Perform the Work so as not to interfere with Owner's operations. Maintain existing exits unless otherwise indicated.
1. Maintain access to existing walkways, corridors, and other adjacent occupied or used facilities. Do not close or obstruct walkways, corridors, or other occupied or used facilities without written permission from Owner and authorities having jurisdiction.
 2. Provide not less than 72 hours' notice to Owner of activities that will affect Owner's operations.
- B. Owner Limited Occupancy of Completed Areas of Construction: Owner reserves the right to occupy and to place and install equipment in completed portions of the Work, prior to Substantial Completion of the Work, provided such occupancy does not interfere with completion of the Work. Such placement of equipment and limited occupancy shall not constitute acceptance of the total Work.
1. Architect will prepare a Certificate of Substantial Completion for each specific portion of the Work to be occupied prior to Owner acceptance of the completed Work.
 2. Obtain a Certificate of Occupancy from authorities having jurisdiction before limited Owner occupancy.
 3. Before limited Owner occupancy, mechanical and electrical systems shall be fully operational, and required tests and inspections shall be successfully completed. On occupancy, Owner will operate and maintain mechanical and electrical systems serving occupied portions of Work.
 4. On occupancy, Owner will assume responsibility for maintenance and custodial service for occupied portions of Work.

1.10 WORK RESTRICTIONS

- A. Comply with restrictions on construction operations.
1. Comply with limitations on use of public streets, work on public streets, rights of way, and other requirements of authorities having jurisdiction.
- B. On-Site Work Hours: Limit work to between 7:00 a.m. to 6:00 p.m., Monday through Friday, unless otherwise indicated. Work hours may be modified to meet Project requirements if approved by Owner and authorities having jurisdiction.
1. Weekend Hours: Coordinate with Owner a minimum of 72 hours in advance and upon approval of Owner.
 2. Hours for Utility Shutdowns: Coordinate with Owner.
 3. Hours for noisy activity: Coordinate with Owner.
- C. Existing Utility Interruptions: Do not interrupt utilities serving facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging for temporary utility services according to requirements indicated:
1. Notify Owner not less than three days in advance of proposed utility interruptions.
 2. Obtain Owner's written permission before proceeding with utility interruptions.

D. Noise, Vibration, Dust, and Odors: Coordinate operations that may result in high levels of noise and vibration, dust, odors, or other disruption to Owner occupancy with Owner.

1. Notify Owner not less than three days in advance of proposed disruptive operations.
2. Obtain Owner's written permission before proceeding with disruptive operations.

E. Smoking and Controlled Substance Restrictions: Use of tobacco products, alcoholic beverages, and other controlled substances on Owner's property is not permitted.

1.11 SPECIFICATION AND DRAWING CONVENTIONS

A. Specification Content: The Specifications use certain conventions for the style of language and the intended meaning of certain terms, words, and phrases when used in particular situations. These conventions are as follows:

1. Imperative mood and streamlined language are generally used in the Specifications. The words "shall," "shall be," or "shall comply with," depending on the context, are implied where a colon (:) is used within a sentence or phrase.
2. Text Color: Text used in the Specifications, including units of measure, manufacturer and product names, and other text may appear in multiple colors or underlined as part of a hyperlink; no emphasis is implied by text with these characteristics.
3. Specification requirements are to be performed by Contractor unless specifically stated otherwise.

B. Division 00 Contracting Requirements: General provisions of the Contract, including General and Supplementary Conditions, apply to all Sections of the Specifications.

C. Division 01 General Requirements: Requirements of Sections in Division 01 apply to the Work of all Sections in the Specifications.

D. Drawing Coordination: Requirements for materials and products identified on Drawings are described in detail in the Specifications.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 011000

SECTION 012100 - ALLOWANCES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This Section includes administrative and procedural requirements governing allowances.
 - 1. Certain items are specified in the Contract Documents by allowances. Allowances have been established in lieu of additional requirements and to defer selection of actual materials and equipment to a later date when additional information is available for evaluation. If necessary, additional requirements will be issued by Change Order.
- B. Types of allowances include the following:
 - 1. Unit cost allowances.
 - 2. Contingency allowances.

1.3 SELECTION AND PURCHASE

- A. At the earliest practical date after award of the Contract, advise Architect of the date when final selection and purchase of each product or system described by an allowance must be completed to avoid delaying the Work.
- B. At Architect's request, obtain proposals for each allowance for use in making final selections. Include recommendations that are relevant to performing the Work.
- C. Purchase products and systems selected by Architect from the designated supplier.

1.4 SUBMITTALS

- A. Submit proposals for purchase of products or systems included in allowances, in the form specified for Change Orders.
- B. Submit invoices or delivery slips to show actual quantities of materials delivered to the site for use in fulfillment of each allowance.
- C. Coordinate and process submittals for allowance items in same manner as for other portions of the Work.

1.5 COORDINATION

- A. Coordinate allowance items with other portions of the Work. Furnish templates as required to coordinate installation.

1.6 UNIT COST ALLOWANCES

- A. Unless otherwise indicated, Contractor's overhead and profit, and similar costs related to products and materials, required and approved by the Owner, under allowance shall be included as part of the Contract Sum and not part of the allowance.

1.7 LUMP SUM ALLOWANCES

- A. Unless otherwise indicated, Contractor's costs for overhead and profit, and similar costs related to products and materials, required and approved by the Owner, under allowance shall be included as part of the Contract Sum and not part of the allowance.

1.8 CONTINGENCY ALLOWANCES

- A. Use the contingency allowance only as directed by Architect for Owner's purposes and only by Change Orders that indicate amounts to be charged to the allowance.
- B. Contractor's overhead, profit, and related costs for products and equipment ordered by Owner under the contingency allowance are included in the allowance and are not part of the Contract Sum.

1.9 UNUSED MATERIALS

- A. Return unused materials purchased under an allowance to manufacturer or supplier for credit to Owner, after installation has been completed and accepted.
 - 1. If requested by Architect, prepare unused material for storage by Owner when it is not economically practical to return the material for credit. Deliver unused material to Owner's storage space.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine products covered by an allowance promptly on delivery for damage or defects. Return damaged or defective products to manufacturer for replacement.

3.2 PREPARATION

- A. Coordinate materials and their installation for each allowance with related materials and installations to ensure that each allowance item is completely integrated and interfaced with related work.

3.3 SCHEDULE OF UNIT COST ALLOWANCES

- A. Unit Cost Allowance No. 1: Include \$750 / 1000 brick for new modular sized brick Type FBS-SW or FBX – SW as specified for selection by Architect for use in repair and replacement of existing brick veneer.
 - 1. Quantities shall be determined by Contractor. Contractor to include overhead and profit in Bid Price.

END OF SECTION 012100

SECTION 012200 - UNIT PRICES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This Section includes administrative and procedural requirements for unit prices.

1.3 DEFINITIONS

- A. Unit price is an amount proposed by bidders, stated on the Bid Form, as a price per unit of measurement for materials or services added to or deducted from the Contract Sum by appropriate modification, if estimated quantities of Work required by the Contract Documents are increased or decreased.

1.4 PROCEDURES

- A. Unit prices include all necessary material, plus cost for delivery, installation, insurance, applicable taxes, overhead, and profit.
- B. Measurement and Payment: Refer to individual Specification Sections for work that requires establishment of unit prices. Methods of measurement and payment for unit prices are specified in those Sections.
- C. Owner reserves the right to reject Contractor's measurement of work-in-place that involves use of established unit prices and to have this work measured, at Owner's expense, by an independent surveyor acceptable to Contractor.
- D. List of Unit Prices: Specification Sections referenced in the schedule contain requirements for materials described under each unit price.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 LIST OF UNIT PRICES

- A. Unit Price No. 1 – Existing roof insulation replacement
 - 1. Description: Provide a unit price per square (100 sf) at 2 inch thickness, for removal and replacement of existing wet or deteriorated insulation with new polyisocyanurate insulation. Price

shall include materials and labor necessary. Base bid insulation removal and replacement is indicated in the construction documents.

- B. Unit Price No. 2 – Replacement of existing metal roof deck
 - 1. Description: Provide a unit price per square foot for removal and replacement of existing metal decking with metal decking of the same profile and gauge. Work will be as directed by the Architect and approved by the Owner.

- C. Unit Price No. 3 – Brick veneer removal and replacement
 - 1. Description: For additional scope of work beyond that indicated on the drawings or specifications, provide a unit price per 12 bricks (16” x 16” area or 1.77 SF) to saw-cut, remove and replace existing broken or deteriorated brick veneer with new FBS – SW or FBX – SW modular brick veneer. Removal and replacement shall include all necessary supplemental scope including, but not limited to, veneer anchorage, temporary support of existing veneer to remain, mortar and cleanup.

- D. Unit Price No. 4 – Mortar repair and pointing
 - 1. Description: For additional scope of work beyond that indicated on the drawings or specifications, provide a unit price per 20 lineal feet for removal and replacement of damaged, missing or deteriorated mortar. Base Bid mortar repair and replacement areas are indicated on the drawings.

- E. Unit Price No. 5 – Sealant replacement
 - 1. Description: For additional scope of work beyond that indicated on the drawings or specifications, provide a unit price for sealant joint removal and reinstallation at new or existing perimeter or control / movement joints per 20 lineal feet.

- F. Unit Price No. 6 – Installation of weeps
 - 1. Description: For additional scope of work beyond that indicated on the drawings or specifications, provide a unit price for installation of new weep tubes at base of brick veneer wall, 24” on center, per 20 lineal feet of wall.

- G. Unit Price No. 7 – Operable Doors in New Storefront
 - 1. Description: Provide the cost for installation of the specified operable door system indicated in the drawings, Elevation 0.AF04, in lieu of the new, fixed storefront system indicated.
 - 2. Price to include removal of existing unit ventilation system and providing the specified alternate HVAC system at that location (See Mechanical and Electrical Drawings)

END OF SECTION 012200

SECTION 012300 - ALTERNATES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This Section includes administrative and procedural requirements for alternates.

1.3 DEFINITIONS

- A. Alternate: An amount proposed by bidders and stated on the Bid Form for certain work defined in the Bidding Requirements that may be added to or deducted from the Base Bid amount if Owner decides to accept a corresponding change either in the amount of construction to be completed or in the products, materials, equipment, systems, or installation methods described in the Contract Documents.
 - 1. The cost or credit for each alternate is the net addition to or deduction from the Contract Sum to incorporate alternate into the Work. No other adjustments are made to the Contract Sum.

1.4 PROCEDURES

- A. Coordination: Modify or adjust affected adjacent work as necessary to completely integrate work of the alternate into Project.
 - 1. Include as part of each alternate, miscellaneous devices, accessory objects, and similar items incidental to or required for a complete installation whether or not indicated as part of alternate.
- B. Notification: Immediately following award of the Contract, notify each party involved, in writing, of the status of each alternate. Indicate if alternates have been accepted, rejected, or deferred for later consideration. Include a complete description of negotiated modifications to alternates.
- C. Execute accepted alternates under the same conditions as other work of the Contract.
- D. Schedule: A Schedule of Alternates is included at the end of this Section. Specification Sections referenced in schedule contain requirements for materials necessary to achieve the work described under each alternate.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 SCHEDULE OF ALTERNATES

- A. Alternate No. 1 – Buff brick veneer cleaning.
 - 1. Provide a lump sum price for cleaning the buff color brick areas on the building according to the requirements of Section 040110 – Masonry Cleaning. Dark color brick scheduled to receive mineral silicate coating shall remain as Base Bid work.

- B. Alternate No. 2 – Operable vent windows
 - 1. Provide a price for integrating two operable window lites into the storefront framing system as indicated on the drawings.

- C. Alternate No. 3 – 30 year TPO roof warranty
 - 1. Provide the cost for all additional materials and labor necessary to increase TPO roofing warranty from 20 years to 30 years.

END OF SECTION 012300

SECTION 012500 - SUBSTITUTION PROCEDURES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section includes administrative and procedural requirements for substitutions.
- B. Related Requirements:
 - 1. Document 002600 "Procurement Substitution Procedures" for requirements for substitution requests prior to award of Contract.
 - 2. Section 012100 "Allowances" for products selected under an allowance.
 - 3. Section 012300 "Alternates" for products selected under an alternate.
 - 4. Section 016000 "Product Requirements" for requirements for submitting comparable product submittals for products by listed manufacturers.

1.3 DEFINITIONS

- A. Substitutions: Changes in products, materials, equipment, and methods of construction from those required by the Contract Documents.
 - 1. Substitutions for Cause: Changes proposed by Contractor that are required due to changed Project conditions, such as unavailability of product, regulatory changes, or unavailability of required warranty terms.
 - 2. Substitutions for Convenience: Changes proposed by Contractor or Owner that are not required to meet other Project requirements but may offer advantage to Contractor or Owner.

1.4 ACTION SUBMITTALS

- A. Substitution Requests: Submit documentation identifying product or fabrication or installation method to be replaced. Include Specification Section number and title and Drawing numbers and titles.
 - 1. Substitution Request Form: Use CSI Substitution Request Form 13.1A.
 - 2. Documentation: Show compliance with requirements for substitutions and the following, as applicable:
 - a. Statement indicating why specified product or fabrication or installation method cannot be provided, if applicable.
 - b. Coordination of information, including a list of changes or revisions needed to other parts of the Work and to construction performed by Owner and separate contractors that will be necessary to accommodate proposed substitution.

- c. Detailed comparison of significant qualities of proposed substitutions with those of the Work specified. Include annotated copy of applicable Specification Section. Significant qualities may include attributes, such as performance, weight, size, durability, visual effect, sustainable design characteristics, warranties, and specific features and requirements indicated. Indicate deviations, if any, from the Work specified.
 - d. Product Data, including drawings and descriptions of products and fabrication and installation procedures.
 - e. Samples, where applicable or requested.
 - f. Certificates and qualification data, where applicable or requested.
 - g. List of similar installations for completed projects, with project names and addresses as well as names and addresses of architects and owners.
 - h. Material test reports from a qualified testing agency, indicating and interpreting test results for compliance with requirements indicated.
 - i. Research reports evidencing compliance with building code in effect for Project.
 - j. Detailed comparison of Contractor's construction schedule using proposed substitutions with products specified for the Work, including effect on the overall Contract Time. If specified product or method of construction cannot be provided within the Contract Time, include letter from manufacturer, on manufacturer's letterhead, stating date of receipt of purchase order, lack of availability, or delays in delivery.
 - k. Cost information, including a proposal of change, if any, in the Contract Sum.
 - l. Contractor's certification that proposed substitution complies with requirements in the Contract Documents, except as indicated in substitution request, is compatible with related materials and is appropriate for applications indicated.
 - m. Contractor's waiver of rights to additional payment or time that may subsequently become necessary because of failure of proposed substitution to produce indicated results.
3. Architect's Action: If necessary, Architect will request additional information or documentation for evaluation within seven days of receipt of a request for substitution. Architect will notify Contractor of acceptance or rejection of proposed substitution within 15 days of receipt of request, or seven days of receipt of additional information or documentation, whichever is later.
- a. Forms of Acceptance: Change Order, Construction Change Directive, or Architect's Supplemental Instructions for minor changes in the Work.
 - b. Use product specified if Architect does not issue a decision on use of a proposed substitution within time allocated.

1.5 QUALITY ASSURANCE

- A. Compatibility of Substitutions: Investigate and document compatibility of proposed substitution with related products and materials. Engage a qualified testing agency to perform compatibility tests recommended by manufacturers.

1.6 PROCEDURES

- A. Coordination: Revise or adjust affected work as necessary to integrate work of the approved substitutions.

1.7 SUBSTITUTIONS

- A. Substitutions for Cause: Submit requests for substitution immediately on discovery of need for change, but not later than 15 days prior to time required for preparation and review of related submittals.

1. Conditions: Architect will consider Contractor's request for substitution when the following conditions are satisfied. If the following conditions are not satisfied, Architect will return requests without action, except to record noncompliance with these requirements:
 - a. Requested substitution is consistent with the Contract Documents and will produce indicated results.
 - b. Substitution request is fully documented and properly submitted.
 - c. Requested substitution will not adversely affect Contractor's construction schedule.
 - d. Requested substitution has received necessary approvals of authorities having jurisdiction.
 - e. Requested substitution is compatible with other portions of the Work.
 - f. Requested substitution has been coordinated with other portions of the Work.
 - g. Requested substitution provides specified warranty.
 - h. If requested substitution involves more than one contractor, requested substitution has been coordinated with other portions of the Work, is uniform and consistent, is compatible with other products, and is acceptable to all contractors involved.

B. Substitutions for Convenience: Architect will consider requests for substitution if received within 60 days after the Notice to Proceed. Requests received after that time may be considered or rejected at discretion of Architect.

1. Conditions: Architect will consider Contractor's request for substitution when the following conditions are satisfied. If the following conditions are not satisfied, Architect will return requests without action, except to record noncompliance with these requirements:
 - a. Requested substitution offers Owner a substantial advantage in cost, time, energy conservation, or other considerations, after deducting additional responsibilities Owner must assume. Owner's additional responsibilities may include compensation to Architect for redesign and evaluation services, increased cost of other construction by Owner, and similar considerations.
 - b. Requested substitution does not require extensive revisions to the Contract Documents.
 - c. Requested substitution is consistent with the Contract Documents and will produce indicated results.
 - d. Substitution request is fully documented and properly submitted.
 - e. Requested substitution will not adversely affect Contractor's construction schedule.
 - f. Requested substitution has received necessary approvals of authorities having jurisdiction.
 - g. Requested substitution is compatible with other portions of the Work.
 - h. Requested substitution has been coordinated with other portions of the Work.
 - i. Requested substitution provides specified warranty.
 - j. If requested substitution involves more than one contractor, requested substitution has been coordinated with other portions of the Work, is uniform and consistent, is compatible with other products, and is acceptable to all contractors involved.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 012500

SECTION 015000 - TEMPORARY FACILITIES AND CONTROLS

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes requirements for temporary enclosures, temporary utilities, support facilities, and security and protection facilities.

1.2 DEFINITIONS

- A. Permanent Enclosure: As determined by Architect, permanent roofing is complete, insulated, and weathertight; exterior walls are complete, insulated and weathertight; and all openings are closed with final, permanent construction.

1.3 USE CHARGES

- A. General: Cost for use charges for temporary facilities shall be included in the Contract Sum. Allow other entities to use temporary services and facilities without cost, including, but not limited to, Owner's construction forces, Architect, occupants of Project, testing agencies, and authorities having jurisdiction.
- B. Sewer Service: Pay sewer service use charges for sewer usage by all entities for construction operations.
- C. Water Service: Pay water service use charges for water used by all entities for construction operations.
- D. Electric Power Service: Pay electric power service use charges for electricity used by all entities for construction operations.

1.4 SUBMITTALS

- A. Site Plan: Show temporary facilities, utility hookups, staging areas, and parking areas for construction personnel.
- B. Roof and Building Envelope Protection / Temporary Roofing: Where demolition, cutting and patching or any construction operations affects any portion of the new or existing building envelope, the Prime Contractor responsible for the work shall provide all temporary enclosures to protect the roof system, building envelope, interior of the building and its contents from damage due to intrusion by weather elements such as rain, snow, ice and temperature fluctuations. Contractor shall submit their protection plan to the Architect for review 10 days prior to commencing such work.
 - a. Materials and methods to provide temporary enclosure of the building envelope.
 - b. Means to remove, divert or collect water runoff in order to prevent water intrusion, and damage to Owner's property, facility or site.
 - c. Means to enclose building envelope and roof at the end of each day and as necessary. No building component shall be left un-protected from the elements over night. No building component shall be left un-protected from the elements if precipitation is anticipated or forecast.
 - d. Written acknowledgement from the Contractor responsible for cutting and patching that any damage resulting from inadequate or missing temporary enclosures will be corrected to the Owner's satisfaction and costs borne by that Contractor.

1.5 QUALITY ASSURANCE

- A. Electric Service: Comply with NECA, NEMA, and UL standards and regulations for temporary electric service. Install service to comply with NFPA 70.
- B. Tests and Inspections: Arrange for authorities having jurisdiction to test and inspect each temporary utility before use. Obtain required certifications and permits.

1.6 PROJECT CONDITIONS

- A. Temporary Use of Permanent Facilities: Installer of each permanent service shall assume responsibility for operation, maintenance, and protection of each permanent service during its use as a construction facility before Owner's acceptance, regardless of previously assigned responsibilities.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Chain-Link Fencing: Minimum 2-inch, galvanized steel, chain-link fabric fencing; minimum 6 feet high, 2 3/8 inch posts with appropriate bracing, tension wires and anchorage for the duration of construction.
- B. Gypsum Board: Minimum 1/2 inch (12.7 mm) thick by 48 inches (1219 mm) wide by maximum available lengths; regular-type panels with tapered edges. Comply with ASTM C 36/C 36M.
- C. Insulation: Unfaced mineral-fiber blanket, manufactured from glass, slag wool, or rock wool; with maximum flame-spread and smoke-developed indexes of 25 and 50, respectively.

2.2 TEMPORARY FACILITIES

- A. Field Offices: When necessary or required, provide prefabricated or mobile units inspected and approved by local authorities having jurisdiction with serviceable finishes, temperature controls, and foundations adequate for normal loading and of sufficient size to accommodate construction personnel, equipment and job site meetings. Placement on site shall be approved in advance by the Owner.

2.3 EQUIPMENT

- A. Fire Extinguishers: Portable, UL rated; with class and extinguishing agent as required by locations and classes of fire exposures.
- B. HVAC Equipment: Unless Owner authorizes use of permanent HVAC system, provide vented, self-contained units for heating or cooling, with individual space thermostatic control.
 - 1. Permanent HVAC System: If Owner authorizes use of permanent HVAC system for temporary use during construction, provide filter with MERV of [8] at each return air grille in system and remove at end of construction.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

- A. Locate facilities where they will serve Project adequately and result in minimum interference with performance of the Work. Relocate and modify facilities as required by progress of the Work.
- B. Provide each facility ready for use when needed to avoid delay. Do not remove until facilities are no longer needed or are replaced by authorized use of completed permanent facilities.

3.2 TEMPORARY UTILITY INSTALLATION

- A. General: Install temporary service or connect to existing service when authorized by Owner.
- B. Sewers and Drainage: Provide temporary utilities if necessary, approved by the Owner and in compliance with local authorities having jurisdiction.
- C. Water Service: Install water service and distribution piping in sizes and pressures adequate for construction.
- D. Sanitary Facilities: Provide temporary toilets, wash facilities, and drinking water for use of construction personnel. Comply with authorities having jurisdiction for type, number, location, operation, and maintenance of fixtures and facilities.
- E. Heating and Cooling: Provide temporary heating and cooling required by construction activities for curing or drying of completed installations or for protecting installed construction from adverse effects of low temperatures or high humidity
- F. Ventilation and Humidity Control: Provide temporary ventilation required by construction activities for curing or drying of completed installations or for protecting installed construction from adverse effects of high humidity.
- G. Electric Power Service: Provide electric power service and distribution system of sufficient size, capacity, and power characteristics required for construction operations.
- H. Lighting: Provide temporary lighting with local switching that provides adequate illumination for construction operations, observations, inspections, and traffic conditions.
- I. Electronic Communication Service: Provide temporary electronic communication service, including e-mail, internet availability or wi-fi in common-use facilities.

3.3 SUPPORT FACILITIES INSTALLATION

- A. General: Comply with the following:
 - 1. Provide incombustible construction for offices, shops, and sheds located within construction area or within 30 feet (9 m) of building lines. Comply with NFPA 241.
 - 2. Maintain support facilities until near Substantial Completion. Remove before Substantial Completion. Personnel remaining after Substantial Completion will be permitted to use permanent facilities, under conditions acceptable to Owner.

- B. Temporary Roads and Paved Areas: Construct and maintain temporary roads and paved areas adequate for construction operations. Locate temporary roads and paved areas in same location as permanent roads and paved areas. Extend temporary roads and paved areas, within construction limits indicated, as necessary for construction operations.
 - 1. Coordinate elevations of temporary roads and paved areas with permanent roads and paved areas.
 - 2. Prepare subgrade and install subbase and base for temporary roads and paved areas according to Division 31 Section "Earth Moving."
 - 3. Recondition base after temporary use, including removing contaminated material, regrading, proofrolling, compacting, and testing.
 - 4. Delay installation of final course of permanent hot-mix asphalt pavement until immediately before Substantial Completion. Repair hot-mix asphalt base-course pavement before installation of final course according to Division 32 Section "Asphalt Paving."
 - C. Traffic Controls: Comply with requirements of authorities having jurisdiction.
 - D. Parking: Use designated areas of Owner's existing parking areas for construction personnel.
 - E. Dewatering Facilities and Drains: Comply with requirements of authorities having jurisdiction. Maintain Project site, excavations, and construction free snow, ice or water.
 - F. Project Identification and Temporary Signs: Provide project identification signs and other directional or informational signs as required to direct construction personnel or public in and around Project site. Install signs where indicated to inform public and individuals seeking entrance to Project. Unauthorized signs are not permitted.
 - G. Lifts and Hoists: Provide facilities necessary for hoisting materials and personnel.
 - H. Existing Stair Usage: Use of Owner's existing stairs will be permitted, as long as stairs are cleaned and maintained in a condition acceptable to Owner. At Substantial Completion, restore stairs to condition existing before initial use.
- 3.4 TEMPORARY ENCLOSURES, SECURITY AND PROTECTION FACILITIES INSTALLATION
- A. Environmental Protection: Provide protection, operate temporary facilities, and conduct construction in ways and by methods that comply with environmental regulations and that minimize possible air, waterway, and subsoil contamination or pollution or other undesirable effects.
 - B. Temporary Erosion and Sedimentation Control: Comply with requirements of local jurisdiction.
 - C. Storm water Control: Comply with authorities having jurisdiction.
 - D. Tree and Plant Protection: Protect trees during construction. Do not store materials or alter soils within or near the dripline of trees and plants to remain.
 - E. Pest Control: Engage pest-control service as necessary during the construction period. Perform control operations lawfully, using environmentally safe materials.
 - F. Security Enclosure and Lockup: Install chain link temporary enclosure around site stored materials and lay down areas. Refer to drawings. Provide lockable entrances to prevent unauthorized entrance, vandalism, theft, and similar violations of security.

- G. Covered Walkway: Erect structurally adequate, protective, covered walkway for passage of individuals along adjacent public street(s) or walkways. Coordinate with entrances, other facilities, and obstructions. Comply with regulations of authorities having jurisdiction.
- H. Temporary Enclosures: Provide lockable, temporary enclosures for protection of construction, in progress and completed, from exposure, foul weather, other construction operations, and similar activities. Provide temporary weathertight enclosure for building exterior.
1. Temporary Enclosures: No construction operations, cutting and patching work affecting the new or existing building envelope shall occur until a plan for temporary patching, protecting and waterproofing of the building element is submitted for review by the Architect.
 2. Where heating or cooling is needed and permanent enclosure is not complete, provide insulated temporary enclosures, constructed, at a minimum of 2 x 4 wood framing, 7/16 OSB exterior sheathing outside, and 1/2 inch gypsum board inside, with 3-1/2 inch batt insulation. Provide temporary flashing or sealants to make enclosure watertight.
- I. Temporary Interior Partitions and Construction Barriers: Provide fire rated, floor-to-structure above, dustproof partitions to limit dust and dirt migration and to separate areas occupied by Owner from fumes and noise.
1. Construct full height dustproof partitions with gypsum wallboard on both sides complying with construction requirements for a 1 hour rated wall. Temporary doors shall be 45 minute rated and shall be self-closing with positive latch to frame.
 2. Where required, provide mineral fiber batt insulation in partitions to provide noise protection to occupied areas.
 3. Seal all joints, penetrations and perimeters.
 4. Provide walk-off mats at each entrance through temporary partition.
- J. Temporary Fire Protection: Install and maintain temporary fire-protection facilities of types needed to protect against reasonably predictable and controllable fire losses. Comply with NFPA 241.
1. Each Contractor shall provide, maintain, and have readily accessible, approved type extinguishers when working adjacent to hazardous areas such as painting and welding. Personnel working on the Project shall be familiarized with the locations and operation of fire extinguishers.
 - a. Use of an open flame prohibited.
 - b. Prohibit smoking on Project site, or as may be required by Owner.
 - c. Prohibit the use of all tobacco products within new or existing building areas.
 2. Supervise welding operations, combustion-type temporary heating units, and similar sources of fire ignition according to requirements of authorities having jurisdiction.
 3. Develop and supervise an overall fire-prevention and -protection program for personnel at Project site. Review needs with local fire department and establish procedures to be followed. Instruct personnel in methods and procedures. Post warnings and information.
 4. Until fire protection needs are supplied by permanent facilities, install and maintain temporary fire protection facilities of the types needed to protect against reasonably predicable and controllable fire losses. Comply with NFPA 10 “Standard for Portable Fire Extinguishers and NFPA 241 “Standard for Safeguarding Construction, Alterations and Demolition Operations.”

3.5 OPERATION, TERMINATION, AND REMOVAL

- A. Supervision: Enforce strict discipline in use of temporary facilities. To minimize waste and abuse, limit availability of temporary facilities to essential and intended uses.

- B. Maintenance: Maintain facilities in good operating condition until removal.
 - 1. Maintain operation of temporary enclosures, heating, cooling, humidity control, ventilation, and similar facilities on a 24-hour basis where required to achieve indicated results and to avoid possibility of damage.
- C. Temporary Facility Changeover: Do not change over from using temporary security and protection facilities to permanent facilities until Substantial Completion.
- D. Termination and Removal: Remove each temporary facility when need for its service has ended, when it has been replaced by authorized use of a permanent facility, or no later than Substantial Completion. Complete or, if necessary, restore permanent construction that may have been delayed because of interference with temporary facility. Repair damaged Work, clean exposed surfaces, and replace construction that cannot be satisfactorily repaired.

END OF SECTION 015000

3

DIVISION

CONCRETE

SECTION 033000 - CAST-IN-PLACE CONCRETE

PART 1 - GENERAL

When the information in this Specification Section conflicts with information on the Structural Construction Drawings, the Structural Construction Drawings shall prevail.

1.1 SUMMARY

- A. Section includes cast-in-place concrete, including formwork, reinforcement, concrete materials, mixture design, placement procedures, and finishes.

1.2 ACTION SUBMITTALS

- A. Material Certificates: For each of the following, signed by manufacturers:
 - 1. Fiber reinforcement.
 - 2. Waterstops.
 - 3. Curing compounds.
 - 4. Floor and slab treatments.
 - 5. Vapor retarders.
- B. Design Mixtures: For each concrete mixture.
- C. Steel Reinforcement Shop Drawings: Placing Drawings that detail fabrication, bending, and placement.

1.3 INFORMATIONAL SUBMITTALS

- A. Slab Jointing Plan: Contractor to indicate location of slab-on-grade contraction joints and construction joints.
 - 1. Joints shall be spaced in a square or rectangular pattern with aspect ratio not to exceed 1.5:1.
 - 2. Spacing shall not exceed 36 times the slab thickness (in inches).
- B. Field quality-control reports, including floor surface flatness and levelness measurements indicating compliance with specified tolerances.

1.4 DELIVERY, STORAGE, AND HANDLING

- A. Steel Reinforcement: Deliver, store, and handle steel reinforcement to prevent bending and damage. Avoid damaging coatings on steel reinforcement.
- B. Waterstops: Store waterstops under cover to protect from moisture, sunlight, dirt, oil, and other contaminants.

1.5 QUALITY ASSURANCE

- A. Quality Standard: ACI 301.

- B. Manufacturer Qualifications: A firm experienced in manufacturing ready-mixed concrete products and that complies with ASTM C 94 requirements for production facilities and equipment.
- C. Testing Agency Qualifications: An independent agency, qualified according to ASTM C 1077 and ASTM E 329 for testing indicated.

1.6 PRECONSTRUCTION TESTING

- A. Preconstruction Testing Service: Engage a qualified testing agency to perform preconstruction testing on concrete mixtures.

1.7 FIELD CONDITIONS

- A. Cold-Weather Placement: Comply with ACI 306.1.
 - 1. Do not use calcium chloride, salt, or other materials containing antifreeze agents or chemical accelerators unless otherwise specified and approved in mixture designs.
- B. Hot-Weather Placement: Comply with ACI 301.

PART 2 - PRODUCTS

2.1 CONCRETE, GENERAL

- A. ACI Publications: Comply with the following unless modified by requirements in the Contract Documents:
 - 1. ACI 301.
 - 2. ACI 117.

2.2 FORM-FACING MATERIALS

- A. Smooth-Formed Finished Concrete: Form-facing panels that provide continuous, true, and smooth concrete surfaces. Furnish in largest practicable sizes to minimize number of joints.
 - 1. Plywood, metal, or other approved panel materials.
 - 2. Exterior-grade plywood panels, suitable for concrete forms, complying with DOC PS 1, and as follows:
 - a. High-density overlay, Class 1 or better.
 - b. Medium-density overlay, Class 1 or better; mill-release agent treated and edge sealed.
 - c. Structural 1, B-B or better; mill oiled and edge sealed.
 - d. B-B (Concrete Form), Class 1 or better; mill oiled and edge sealed.
- B. Chamfer Strips: Wood, metal, PVC, or rubber strips.
- C. Form-Release Agent: Commercially formulated form-release agent that does not bond with, stain, or adversely affect concrete surfaces and does not impair subsequent treatments of concrete surfaces. Provide rust inhibitor.

- D. Form Ties: Factory-fabricated, removable or snap-off glass-fiber-reinforced plastic or metal form ties designed to resist lateral pressure of fresh concrete on forms and to prevent spalling of concrete on removal.
1. Furnish units that leave no corrodible metal closer than 1 inch to the plane of exposed concrete surface.
 2. Furnish ties that, when removed, leave holes no larger than 1 inch in diameter in concrete surface.
 3. Furnish ties with integral water-barrier plates to walls indicated to receive dampproofing or waterproofing.

2.3 CONCRETE MATERIALS

A. Cementitious Materials:

1. Portland Cement: ASTM C 150, Type I/II, gray.
2. Fly Ash: ASTM C 618, Class F or C.
3. Slag Cement: ASTM C 989/C 989M, Grade 100 or 120.

B. Normal-Weight Aggregates: ASTM C 33, graded.

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

C. Lightweight Aggregate: ASTM C 330/C 330M, 1-inch nominal maximum aggregate size.

D. Air-Entraining Admixture: ASTM C 260.

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

1. Water-Reducing Admixture: ASTM C 494, Type A.
2. Retarding Admixture: ASTM C 494, Type B.
3. Water-Reducing and Retarding Admixture: ASTM C 494, Type D.
4. High-Range, Water-Reducing Admixture: ASTM C 494, Type F.
5. High-Range, Water-Reducing and Retarding Admixture: ASTM C 494, Type G.
6. Plasticizing and Retarding Admixture: ASTM C 1017, Type II.

F. Water: ASTM C 94 and potable.

2.4 STEEL REINFORCEMENT

A. Reinforcing Bars: ASTM A 615/A 615M, Grade 60, deformed.

B. Epoxy-Coated Reinforcing Bars: ASTM A 615, Grade 60, deformed bars,, epoxy coated, with less than 2 percent damaged coating in each 12-inch bar length.

C. Plain-Steel Welded-Wire Reinforcement: ASTM A 1064, plain, fabricated from as-drawn steel wire into flat sheets.

2.5 REINFORCEMENT ACCESSORIES

- A. Bar Supports: Bolsters, chairs, spacers, and other devices for spacing, supporting, and fastening reinforcing bars and welded-wire reinforcement in place. Manufacture bar supports from steel wire, plastic, or precast concrete according to CRSI's "Manual of Standard Practice."
- B. Joint Dowel Bars: ASTM A 615, Grade 60, plain-steel bars, cut true to length with ends square and free of burrs.
- C. Epoxy-Coated Joint Dowel Bars: ASTM A 615, Grade 60, plain-steel bars, ASTM A 775 epoxy coated.
- D. Epoxy Repair Coating: Liquid, two-part, epoxy repair coating; compatible with epoxy coating on reinforcement and complying with ASTM A 775.

2.6 FIBER REINFORCEMENT

- A. Synthetic Micro-Fiber: Blended monofilament and fibrillated polypropylene micro-fibers engineered and designed for use in concrete, complying with ASTM C 1116, Type III, no less than 2 inches long.
 - 1. Forta-Ferro, Forta Corporation
 - 2. Tuff-Strand, Euclid

2.7 WATERSTOPS

- A. Self-Expanding Butyl Strip Waterstops: Manufactured rectangular or trapezoidal strip, butyl rubber with sodium bentonite or other hydrophilic polymers, for adhesive bonding to concrete, 3/4 by 1 inch.

2.8 VAPOR RETARDERS

- A. Sheet Vapor Retarder: ASTM E 1745, Class A, 15 mils thick low-permeance polyolefin with Water Vapor Permeance (ASTM E96): 0.025 gr./ft²/hr. or lower. Include manufacturer's recommended adhesive or pressure-sensitive tape.
 - 1. Products shall include:
 - a. Carlisle Coatings & Waterproofing, Inc.; Blackline 400.
 - b. Fortifiber Building Systems Group; Moistop Ultra 15.
 - c. Grace Construction Products, W. R. Grace & Co.; Florprufe 120.
 - d. Meadows, W. R., Inc.; Perminator 15 mil.
 - e. Reef Industries, Inc.; Griffolyn 15 mil.
 - f. Stego Industries, LLC; Stego Wrap 15 mil Class A.

2.9 CURING MATERIALS

- A. Evaporation Retarder: Waterborne, monomolecular film forming, manufactured for application to fresh concrete.
- B. Absorptive Cover: AASHTO M 182, Class 2, burlap cloth made from jute or kenaf, weighing approximately 9 oz./sq. yd. when dry.
- C. Moisture-Retaining Cover: ASTM C 171, polyethylene film or white burlap-polyethylene sheet.

D. Water: Potable.

2.10 RELATED MATERIALS

A. Expansion- and Isolation-Joint-Filler Strips: ASTM D 1751, asphalt-saturated cellulosic fiber.

2.11 CONCRETE MIXTURES, GENERAL

A. Prepare design mixtures for each type and strength of concrete, proportioned on the basis of laboratory trial mixture or field test data, or both, according to ACI 301.

1. Use a qualified independent testing agency for preparing and reporting proposed mixture designs based on laboratory trial mixtures.

B. Cementitious Materials: Limit percentage, by weight, of cementitious materials other than portland cement in concrete as follows:

1. Fly Ash: 25 percent.

2. Combined Fly Ash and Pozzolan: 25 percent.

3. Ground Granulated Blast-Furnace Slag: 35 percent.

4. Combined Fly Ash or Pozzolan and Ground Granulated Blast-Furnace Slag: 50 percent portland cement minimum, with fly ash or pozzolan not exceeding 25 percent.

C. Admixtures: Use admixtures according to manufacturer's written instructions.

1. Use water-reducing and retarding admixture when required by high temperatures, low humidity, or other adverse placement conditions.

2. Use water-reducing admixture in pumped concrete, concrete required to be watertight, and concrete with a w/c ratio below 0.50.

2.12 CONCRETE MIXTURES FOR BUILDING ELEMENTS

A. Footings: Normal-weight concrete.

1. Minimum Compressive Strength: 3000 psi at 28 days.

2. Maximum W/C Ratio: 0.52.

3. Slump Limit: 4 inches, plus or minus 1 inch.

B. Foundation Walls and Grade Beams: Normal-weight concrete.

1. Minimum Compressive Strength: 4000 psi at 28 days.

2. Maximum W/C Ratio: 0.48.

3. Slump Limit: 4 inches, plus or minus 1 inch.

4. Air Content: 6 percent, plus or minus 1.5 percent at point of delivery for 1-inch nominal maximum aggregate size.

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

1. Minimum Compressive Strength: 4000 psi at 28 days.

2. Maximum W/C Ratio: 0.48.

3. Minimum Cementitious Materials Content: 520 lb/cu. yd..

4. Slump Limit: 4 inches, plus or minus 1 inch.

5. Air Content: Do not allow air content of trowel-finished floors to exceed 3 percent.

6. Synthetic Macro-Fiber: Uniformly disperse in concrete mixture at manufacturer's recommended rate, but not less than a rate of 3.0 lb/cu. yd.

D. Slabs-on-Grade Exterior Exposure: Normal-weight concrete.

1. Minimum Compressive Strength: 4500 psi at 28 days.
2. Maximum W/C Ratio: 0.45.
3. Minimum Cementitious Materials Content: 520 lb/cu. yd..
4. Slump Limit: 4 inches, plus or minus 1 inch.
5. Air Content: 6 percent, plus or minus 1.5 percent at point of delivery for 1-inch nominal maximum aggregate size.
6. Synthetic Macro-Fiber: Uniformly disperse in concrete mixture at manufacturer's recommended rate, but not less than a rate of 3.0 lb/cu. yd.

2.13 FABRICATING REINFORCEMENT

- A. Fabricate steel reinforcement according to CRSI's "Manual of Standard Practice."

2.14 CONCRETE MIXING

- A. Ready-Mixed Concrete: Measure, batch, mix, and deliver concrete according to ASTM C 94/C 94M, and furnish batch ticket information.
 1. When air temperature is between 85 and 90 deg F, reduce mixing and delivery time from 1-1/2 hours to 75 minutes; when air temperature is above 90 deg F, reduce mixing and delivery time to 60 minutes.

PART 3 - EXECUTION

3.1 FORMWORK INSTALLATION

- A. Design, erect, shore, brace, and maintain formwork, according to ACI 301, to support vertical, lateral, static, and dynamic loads, and construction loads that might be applied, until structure can support such loads.
- B. Construct formwork so concrete members and structures are of size, shape, alignment, elevation, and position indicated, within tolerance limits of ACI 117.
- C. Chamfer exterior corners and edges of permanently exposed concrete.
- D. Clean forms and adjacent surfaces to receive concrete. Remove chips, wood, sawdust, dirt, and other debris just before placing concrete.
- E. Coat contact surfaces of forms with form-release agent, according to manufacturer's written instructions, before placing reinforcement.

3.2 REMOVING AND REUSING FORMS

- A. General: Formwork for sides of beams, walls, columns, and similar parts of the Work that does not support weight of concrete may be removed after cumulatively curing at not less than 50 deg F for 24 hours after placing concrete. Concrete has to be hard enough to not be damaged by form-removal operations, and curing and protection operations need to be maintained.
- B. When forms are reused, clean surfaces, remove fins and laitance, and tighten to close joints. Align and secure joints to avoid offsets. Do not use patched forms for exposed concrete surfaces unless approved by Architect.

3.3 STEEL REINFORCEMENT INSTALLATION

- A. General: Comply with CRSI's "Manual of Standard Practice" for fabricating, placing, and supporting reinforcement.
 - 1. Do not cut or puncture vapor retarder. Repair damage and reseal vapor retarder before placing concrete.
- B. Clean reinforcement of loose rust and mill scale, earth, ice, and other foreign materials that reduce bond to concrete.
- C. Accurately position, support, and secure reinforcement against displacement. Locate and support reinforcement with bar supports to maintain minimum concrete cover. Do not tack weld crossing reinforcing bars.
- D. Set wire ties with ends directed into concrete, not toward exposed concrete surfaces.
- E. Epoxy-Coated Reinforcement: Repair cut and damaged epoxy coatings with epoxy repair coating according to ASTM D 3963. Use epoxy-coated steel wire ties to fasten epoxy-coated steel reinforcement.

3.4 EMBEDDED ITEM INSTALLATION

- A. Place and secure anchorage devices and other embedded items required for adjoining work that is attached to or supported by cast-in-place concrete. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
- B. Install anchor rods, accurately located, to elevations required and complying with tolerances in Section 7.5 of AISC's "Code of Standard Practice for Steel Buildings and Bridges."

3.5 VAPOR-RETARDER INSTALLATION

- A. Sheet Vapor Retarders: Place, protect, and repair sheet vapor retarder according to ASTM E 1643 and manufacturer's written instructions.
 - 1. Lap joints 6 inches and seal with manufacturer's recommended tape.

3.6 JOINTS

- A. General: Construct joints true to line with faces perpendicular to surface plane of concrete.
- B. Construction Joints: Install so strength and appearance of concrete are not impaired, at locations indicated or as approved by Architect.
 - 1. Form keyed joints as indicated. Embed keys at least 1-1/2 inches into concrete.
 - 2. Space vertical joints in walls not to exceed the guidelines as described on the contract documents. Locate joints beside piers integral with walls, near corners, and in concealed locations where possible.
 - 3. Use a bonding agent at locations where fresh concrete is placed against hardened or partially hardened concrete surfaces.
- C. Contraction Joints in Slabs-on-Grade: Form weakened-plane contraction joints, sectioning concrete into areas as indicated. Construct contraction joints for a depth equal to at least one-fourth of concrete thickness as follows:
 - 1. Sawed Joints: Form contraction joints with power saws equipped with shatterproof abrasive or diamond-rimmed blades. Cut 1/8-inch- wide joints into concrete when cutting action does not tear, abrade, or otherwise damage surface and before concrete develops random contraction cracks.
- D. Isolation Joints in Slabs-on-Grade: Install joint-filler strips at slab junctions with vertical surfaces, such as column pedestals, foundation walls, grade beams, and other locations, as indicated.
 - 1. Extend joint-filler strips full width and depth of joint, terminating flush with finished concrete surface unless otherwise indicated.
 - 2. Terminate full-width joint-filler strips not less than 1/2 inch or more than 1 inch below finished concrete surface where joint sealants, specified in Section 079200 "Joint Sealants," are indicated.
 - 3. Install joint-filler strips in lengths as long as practicable. Where more than one length is required, lace or clip sections together.
 - 4. Provide round isolation joints at all steel columns. Size round column fiber forms to maintain minimum 1-1/2" clearance of base plate.
- E. Doweled Joints: Install dowel bars and support assemblies at joints where indicated. Lubricate or asphalt coat one-half of dowel length to prevent concrete bonding to one side of joint.

3.7 CONCRETE PLACEMENT

- A. Before placing concrete, verify that installation of formwork, reinforcement, and embedded items is complete and that required inspections are completed.
- B. Do not add water to concrete during delivery, at Project Site, or during placement unless explicitly noted on approved mix design.
- C. Deposit concrete continuously in one layer or in horizontal layers of such thickness that no new concrete is placed on concrete that has hardened enough to cause seams or planes of weakness. If a section cannot be placed continuously, provide construction joints as indicated. Deposit concrete to avoid segregation.
 - 1. Consolidate placed concrete with mechanical vibrating equipment according to ACI 301.
- D. Deposit and consolidate concrete for floors and slabs in a continuous operation, within limits of construction joints, until placement of a panel or section is complete.
 - 1. Consolidate concrete during placement operations so concrete is thoroughly worked around reinforcement and other embedded items and into corners.
 - 2. Maintain reinforcement in position on chairs during concrete placement.

3. Screed slab surfaces with a straightedge and strike off to correct elevations.
 4. Slope surfaces uniformly to drains where required.
 5. Begin initial floating using bull floats or darbies to form a uniform and open-textured surface plane, before excess bleedwater appears on the surface. Do not further disturb slab surfaces before starting finishing operations.
- E. Cold-Weather Placement: Comply with ACI 306.1 and as follows. Protect concrete work from physical damage or reduced strength that could be caused by frost, freezing actions, or low temperatures.
1. When average high and low temperature is expected to fall below 40 deg F for three successive days, maintain delivered concrete mixture temperature within the temperature range required by ACI 301.
 2. Do not use frozen materials or materials containing ice or snow. Do not place concrete on frozen subgrade or on subgrade containing frozen materials.
 3. Do not use calcium chloride, salt, or other materials containing antifreeze agents or chemical accelerators unless otherwise specified and approved in mixture designs.
- F. Hot-Weather Placement: Comply with ACI 301 and as follows:
1. Maintain concrete temperature below 90 deg F at time of placement. Chilled mixing water or chopped ice may be used to control temperature, provided water equivalent of ice is calculated to total amount of mixing water. Using liquid nitrogen to cool concrete is Contractor's option.
 2. Fog-spray forms, steel reinforcement, and subgrade just before placing concrete. Keep subgrade uniformly moist without standing water, soft spots, or dry areas.

3.8 FINISHING FORMED SURFACES

- A. Rough-Formed Finish: As-cast concrete texture imparted by form-facing material with tie holes and defects repaired and patched. Remove fins and other projections that exceed specified limits on formed-surface irregularities.
1. Apply to concrete surfaces not exposed to public view.
- B. Smooth-Formed Finish: As-cast concrete texture imparted by form-facing material, arranged in an orderly and symmetrical manner with a minimum of seams. Repair and patch tie holes and defects. Remove fins and other projections that exceed specified limits on formed-surface irregularities.
1. Apply to concrete surfaces exposed to public view, to receive a rubbed finish, or to be covered with a coating or covering material applied directly to concrete.
- C. Rubbed Finish: Apply the following to smooth-formed-finished as-cast concrete where indicated:
1. Smooth-Rubbed Finish: Not later than one day after form removal, moisten concrete surfaces and rub with carborundum brick or another abrasive until producing a uniform color and texture. Do not apply cement grout other than that created by the rubbing process.
 2. Grout-Cleaned Finish: Wet concrete surfaces and apply grout of a consistency of thick paint to coat surfaces and fill small holes. Mix 1 part portland cement to 1-1/2 parts fine sand with a 1:1 mixture of bonding admixture and water. Add white portland cement in amounts determined by trial patches, so color of dry grout matches adjacent surfaces. Scrub grout into voids and remove excess grout. When grout whitens, rub surface with clean burlap and keep surface damp by fog spray for at least 36 hours.
- D. Related Unformed Surfaces: At tops of walls, horizontal offsets, and similar unformed surfaces adjacent to formed surfaces, strike off smooth and finish with a texture matching adjacent formed surfaces.

Continue final surface treatment of formed surfaces uniformly across adjacent unformed surfaces unless otherwise indicated.

3.9 FINISHING FLOORS AND SLABS

- A. General: Comply with ACI 302.1R recommendations for screeding, restraighening, and finishing operations for concrete surfaces. Do not wet concrete surfaces.
- B. Float Finish: Consolidate surface with power-driven floats or by hand floating if area is small or inaccessible to power-driven floats. Restraighten, cut down high spots, and fill low spots. Repeat float passes and restraighening until surface is left with a uniform, smooth, granular texture.
 - 1. Apply float finish to surfaces to receive trowel finish and to be covered with fluid-applied or sheet waterproofing, built-up or membrane roofing, or sand-bed terrazzo.
- C. Trowel Finish: After applying float finish, apply first troweling and consolidate concrete by hand or power-driven trowel. Continue troweling passes and restraighten until surface is free of trowel marks and uniform in texture and appearance. Grind smooth any surface defects that would telegraph through applied coatings or floor coverings.
 - 1. Apply a trowel finish to surfaces exposed to view or to be covered with resilient flooring, carpet, ceramic or quarry tile set over a cleavage membrane, paint, or another thin-film-finish coating system.
 - 2. Finish surfaces to the following tolerances, according to ASTM E 1155, for a randomly trafficked floor surface:
 - a. Specified overall values of flatness, F(F) 35; and of levelness, F(L) 25; with minimum local values of flatness, F(F) 24; and of levelness, F(L) 17.
- D. Broom Finish: Apply a broom finish to exterior concrete platforms, steps, ramps, and elsewhere as indicated.
 - 1. Immediately after float finishing, slightly roughen trafficked surface by brooming with fiber-bristle broom perpendicular to main traffic route. Coordinate required final finish with Architect before application.

3.10 MISCELLANEOUS CONCRETE ITEMS

- A. Filling In: Fill in holes and openings left in concrete structures after work of other trades is in place unless otherwise indicated. Mix, place, and cure concrete, as specified, to blend with in-place construction. Provide other miscellaneous concrete filling indicated or required to complete the Work.
- B. Equipment Housekeeping Pads:
 - 1. Coordinate sizes and locations of concrete bases with actual equipment provided.
 - 2. Construct concrete bases 4 inches high unless otherwise indicated; and extend base not less than 6 inches in each direction beyond the maximum dimensions of supported equipment unless otherwise indicated or unless required for seismic anchor support.
 - 3. Install hooked dowel rods to connect concrete base to concrete floor. Unless otherwise indicated, install dowel rods on 18-inch centers around the full perimeter of concrete base.
 - 4. For supported equipment, install epoxy-coated anchor bolts that extend through concrete base, and anchor into structural concrete substrate.
 - 5. Prior to pouring concrete, place and secure anchorage devices. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.

6. Cast anchor-bolt insert into bases. Install anchor bolts to elevations required for proper attachment to supported equipment.

3.11 CONCRETE PROTECTING AND CURING

- A. General: Protect freshly placed concrete from premature drying and excessive cold or hot temperatures. Comply with ACI 306.1 for cold-weather protection and ACI 305.1 for hot-weather protection during curing.
- B. Evaporation Retarder: Apply evaporation retarder to unformed concrete surfaces if hot, dry, or windy conditions cause moisture loss approaching 0.2 lb/sq. ft. x h before and during finishing operations. Apply according to manufacturer's written instructions after placing, screeding, and bull floating or darbying concrete, but before float finishing.
- C. Formed Surfaces: Cure formed concrete surfaces, including underside of beams, supported slabs, and other similar surfaces. If forms remain during curing period, moist cure after loosening forms. If removing forms before end of curing period, continue curing for remainder of curing period.
- D. Cure concrete according to ACI 308.1, by one or a combination of the following methods:
 1. Moisture Curing: Keep surfaces continuously moist for not less than seven days.
 2. Moisture-Retaining-Cover Curing: Cover concrete surfaces with moisture-retaining cover for curing concrete, placed in widest practicable width, with sides and ends lapped at least 12 inches, and sealed by waterproof tape or adhesive. Cure for not less than seven days. Immediately repair any holes or tears during curing period, using cover material and waterproof tape.
 3. Curing Compound: Apply uniformly in continuous operation by power spray or roller according to manufacturer's written instructions. Recoat areas subjected to heavy rainfall within three hours after initial application. Maintain continuity of coating and repair damage during curing period.
 - a. Removal: After curing period has elapsed, remove curing compound without damaging concrete surfaces by method recommended by curing compound manufacturer unless manufacturer certifies curing compound does not interfere with bonding of floor covering used on Project.
 4. Curing and Sealing Compound: Apply uniformly to floors and slabs indicated in a continuous operation by power spray or roller according to manufacturer's written instructions. Recoat areas subjected to heavy rainfall within three hours after initial application. Repeat process 24 hours later and apply a second coat. Maintain continuity of coating and repair damage during curing period.

3.12 CONCRETE SURFACE REPAIRS

- A. Defective Concrete: Repair and patch defective areas when approved by Architect. Remove and replace concrete that cannot be repaired and patched to Architect's approval.
- B. Perform structural repairs of concrete, subject to Architect's approval, using epoxy adhesive and patching mortar. Notify Architect of repairs and provide detailed methods for approval prior to beginning repairs.
- C. Patching Mortar: Mix dry-pack patching mortar, consisting of 1 part portland cement to 2-1/2 parts fine aggregate passing a No. 16 sieve, using only enough water for handling and placing.

- D. Repairing Formed Surfaces: Surface defects include color and texture irregularities, cracks, spalls, air bubbles, honeycombs, rock pockets, fins and other projections on the surface. Defects also include stains and other discolorations in public view that cannot be removed by cleaning.
1. Immediately after form removal, cut out honeycombs, rock pockets, and voids more than 1/2 inch in any dimension to solid concrete. Limit cut depth to 3/4 inch. Make edges of cuts perpendicular to concrete surface. Clean, dampen with water, and brush-coat holes and voids with bonding agent. Fill and compact with patching mortar before bonding agent has dried. Fill form-tie voids with patching mortar or cone plugs secured in place with bonding agent.
 2. Repair defects on surfaces by blending white portland cement and standard portland cement so that, when dry, patching mortar matches surrounding color. Patch a test area at inconspicuous locations to verify mixture and color match before proceeding with patching. Compact mortar in place and strike off slightly higher than surrounding surface.
- E. Repairing Unformed Surfaces: Test unformed surfaces, such as floors and slabs, for finish and verify surface tolerances specified for each surface. Correct low and high areas. Test surfaces sloped to drain for trueness of slope and smoothness; use a sloped template.
1. Repair finished surfaces containing defects. Surface defects include spalls, popouts, honeycombs, rock pockets, crazing and cracks in excess of 0.01 inch wide or that penetrate to reinforcement or completely through unreinforced sections regardless of width, and other objectionable conditions.
 2. After concrete has cured at least 14 days, correct high areas by grinding.
 3. Correct low areas scheduled to remain exposed with a repair topping. Cut out low areas to ensure a minimum repair topping depth of 1/4 inch to match adjacent floor elevations. Prepare, mix, and apply repair topping and primer according to manufacturer's written instructions to produce a smooth, uniform, plane, and level surface.
 4. Correct other low areas scheduled to receive floor coverings with a repair underlayment. Prepare, mix, and apply repair underlayment and primer according to manufacturer's written instructions to produce a smooth, uniform, plane, and level surface. Feather edges to match adjacent floor elevations.
 5. Repair defective areas, except random cracks and single holes 1 inch or less in diameter, by cutting out and replacing with fresh concrete. Remove defective areas with clean, square cuts and expose steel reinforcement with at least a 3/4-inch clearance all around. Dampen concrete surfaces in contact with patching concrete and apply bonding agent. Mix patching concrete of same materials and mixture as original concrete, except without coarse aggregate. Place, compact, and finish to blend with adjacent finished concrete. Cure in same manner as adjacent concrete.
 6. Repair random cracks and single holes 1 inch or less in diameter with patching mortar. Groove top of cracks and cut out holes to sound concrete and clean off dust, dirt, and loose particles. Dampen cleaned concrete surfaces and apply bonding agent. Place patching mortar before bonding agent has dried. Compact patching mortar and finish to match adjacent concrete. Keep patched area continuously moist for at least 72 hours.

3.13 FIELD QUALITY CONTROL

- A. Special Inspections: Owner will engage a special inspector to perform field tests and inspections and prepare test reports.
- B. Inspections:
1. Steel reinforcement placement.
 2. Headed bolts and studs.
 3. Verification of use of required design mixture.
 4. Concrete placement, including conveying and depositing.
 5. Curing procedures and maintenance of curing temperature.

- C. Concrete Tests: Testing of composite samples of fresh concrete obtained according to ASTM C 172 shall be performed according to the following requirements:
1. Testing Frequency: Obtain one composite sample for each day's pour of each concrete mixture exceeding 5 cu. yd., but less than 25 cu. yd., plus one set for each additional 50 cu. yd. or fraction thereof.
 2. Slump: ASTM C 143; one test at point of placement for each composite sample, but not less than one test for each day's pour of each concrete mixture. Perform additional tests when concrete consistency appears to change.
 3. Air Content: ASTM C 231, pressure method, for normal-weight concrete; one test for each composite sample, but not less than one test for each day's pour of each concrete mixture.
 4. Concrete Temperature: ASTM C 1064; one test hourly when air temperature is 40 deg F and below or 80 deg F and above, and one test for each composite sample.
 5. Unit Weight: ASTM C 567; one test for each composite sample, but not less than one test for each day's pour of each concrete mixture.
 6. Compression Test Specimens: ASTM C 31.
 7. Compressive-Strength Tests: ASTM C 39; test one set of two laboratory-cured specimens at 7 days and one set of two specimens at 28 days.
 - a. Test one set of two field-cured specimens at 7 days and one set of two specimens at 28 days.
 - b. A compressive-strength test shall be the average compressive strength from a set of two specimens obtained from same composite sample and tested at age indicated.
 8. When strength of field-cured cylinders is less than 85 percent of companion laboratory-cured cylinders, Contractor shall evaluate operations and provide corrective procedures for protecting and curing in-place concrete.
 9. Strength of each concrete mixture will be satisfactory if every average of any three consecutive compressive-strength tests equals or exceeds specified compressive strength and no compressive-strength test value falls below specified compressive strength by more than 500 psi.
 10. Test results shall be reported in writing to Architect, concrete manufacturer, and Contractor within 48 hours of testing. Reports of compressive-strength tests shall contain Project identification name and number, date of concrete placement, name of concrete testing and inspecting agency, location of concrete batch in Work, design compressive strength at 28 days, concrete mixture proportions and materials, compressive breaking strength, and type of break for both 7- and 28-day tests.
 11. Nondestructive Testing: Impact hammer, sonoscope, or other nondestructive device may not be used.
 12. Additional Tests: Testing and inspecting agency shall make additional tests of concrete when test results indicate that slump, air entrainment, compressive strengths, or other requirements have not been met, as directed by Architect. Testing and inspecting agency may conduct tests to determine adequacy of concrete by cored cylinders complying with ASTM C 42 or by other methods as directed by Architect.
 13. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.
 14. Correct deficiencies in the Work that test reports and inspections indicate do not comply with the Contract Documents.

- D. Measure floor and slab flatness and levelness according to ASTM E 1155 within 48 hours of finishing.

END OF SECTION 033000

4

DIVISION

MASONRY

SECTION 040110 - MASONRY CLEANING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section includes cleaning the following:
 - 1. General cleaning of existing masonry surfaces to remove dirt and biological growth.
 - 2. Spot cleaning of masonry surfaces to remove paint, graffiti where indicated.

1.3 ALTERNATES

- A. Alternate Bid Pricing:
 - 1. Refer to Section – 012300 for requirements related to Alternate Bid pricing for a portion of the brick masonry cleaning.

1.4 PRE-CONSTRUCTION MEETINGS

- A. Review the following items at contractor's pre-construction meeting.
 - 1. Review methods and procedures related to cleaning masonry including, but not limited to, the following:
 - a. Verify masonry-cleaning equipment and facilities needed to make progress and avoid delays.
 - b. Cleaning program.
 - c. Coordination with the building occupants.

1.5 WORK SEQUENCE

- A. Perform masonry-cleaning work in the following sequence:
 - 1. Inspect for open mortar joints. Where repairs are required, delay further cleaning work until after repairs are completed, cured, and dried to prevent the intrusion of water and other cleaning materials into the wall.
 - 2. Remove paint.
 - 3. Clean masonry surfaces.

1.6 ACTION SUBMITTALS

- A. Product Data: For each type of product.
 - 1. Include material descriptions and application instructions.
 - 2. Include test data substantiating that products comply with requirements.

1.7 QUALITY ASSURANCE

- A. Paint-Remover Manufacturer: A firm regularly engaged in producing masonry cleaners that have been used for similar applications with successful results, and with factory-authorized service representatives who are available for consultation and Project-site inspection and testing, and on-site assistance.
- B. Cleaning Program: Prepare a written cleaning program that describes cleaning process in detail, including materials, methods, and equipment to be used; protection of surrounding materials; and control of runoff during operations. Include provisions for supervising worker performance and preventing damage.
- C. Mockups: If requested by Owner, prepare mockups of cleaning on existing surfaces to demonstrate aesthetic effects and to set quality standards for materials and execution.

PART 2 - PRODUCTS

2.1 PAINT REMOVERS

- A. Paint Remover: Manufacturer's standard paint removal chemical recommended by paint removal manufacturer, for removing paint from masonry.

2.2 CLEANING MATERIALS

- A. Water: Potable.
- B. Detergent Solution, Job Mixed: Solution prepared by mixing 2 cups (0.5 L) of tetrasodium pyrophosphate (TSPP), 1/2 cup (125 mL) of laundry detergent, and 20 quarts (20 L) of hot water for every 5 gal. (20 L) of solution required.
- C. Mold, Mildew, and Algae Remover, Job Mixed: Solution prepared by mixing 2 cups (0.5 L) of tetrasodium pyrophosphate (TSPP), 5 quarts (5 L) of 5 percent sodium hypochlorite (bleach), and 15 quarts (15 L) of hot water for every 5 gal. (20 L) of solution required.
- D. Nonacidic Gel Cleaner: Manufacturer's standard gel formulation, with pH between 6 and 9, that contains detergents with chelating agents and is specifically formulated for cleaning masonry surfaces.
- E. Nonacidic Liquid Cleaner: Manufacturer's standard mildly alkaline liquid cleaner formulated for removing mold, mildew, and other organic soiling from ordinary building materials, including polished stone, brick, aluminum, plastics, and wood.

2.3 CHEMICAL CLEANING SOLUTIONS

- A. Dilute chemical cleaners with water to produce solutions not exceeding concentration recommended in writing by chemical-cleaner manufacturer.

PART 3 - EXECUTION

3.1 MASONRY-CLEANING SPECIALIST

- A. Masonry-Cleaning Specialist Firms: Subject to compliance with requirements, the contractor may engage a masonry cleaning specialist experienced in the types of cleaning required in the areas indicated in the documents.

3.2 PROTECTION

- A. Comply with each manufacturer's written instructions for protecting building and other surfaces against damage from exposure to its products. Prevent paint removers and chemical cleaning solutions from coming into contact with people, motor vehicles, landscaping, buildings, and other surfaces that could be harmed by such contact.

3.3 CLEANING MASONRY, GENERAL

- A. Cleaning Appearance Standard: Cleaned surfaces are to have a uniform appearance as viewed from 60 feet away by Architect.
- B. Proceed with cleaning in an orderly manner. Ensure that dirty residues and rinse water do not wash over dry, cleaned surfaces.
- C. Use only those cleaning methods indicated for each masonry material and location.
 - 1. Brushes: Do not use wire brushes or brushes that are not resistant to chemical cleaner being used.
 - 2. Spray Equipment: Use spray equipment that provides controlled application at volume and pressure indicated, measured at nozzle. Adjust pressure and volume to ensure that cleaning methods do not damage surfaces, including joints.

3.4 PAINT REMOVAL

- A. Paint-Remover Application, General: Apply paint removers according to paint-remover manufacturer's written instructions. Do not allow paint removers to remain on surface for periods longer than those indicated or recommended in writing by manufacturer.

3.5 CLEANING MASONRY

- A. Cold-Water Soak:
 - 1. Apply cold water by intermittent spraying to keep surface moist.
 - 2. Use perforated hoses or other means that apply a fine water mist to entire surface being cleaned.

3. Remove soil and softened surface encrustation from surface with cold water applied by low-pressure spray.

B. Detergent Cleaning:

1. Wet surface with water applied by low-pressure spray.
2. Scrub surface with detergent solution using medium-soft brushes until soil is thoroughly dislodged and can be removed by rinsing. Use small brushes to remove soil from mortar joints and crevices. Dip brush in solution often to ensure that adequate fresh detergent is used and that surface remains wet.
3. Rinse with water applied by low-pressure spray to remove detergent solution and soil.
4. Repeat cleaning procedure above where required to produce cleaning effect established by mockup.

C. Mold, Mildew, and Algae Removal:

1. Wet surface with] water applied by low-pressure spray.
2. Apply mold, mildew, and algae remover by brush or low pressure spray.
3. Scrub surface with medium-soft brushes until mold, mildew, and algae are thoroughly dislodged and can be removed by rinsing. Use small brushes for mortar joints and crevices. Dip brush in mold, mildew, and algae remover often to ensure that adequate fresh cleaner is used and that surface remains wet.
4. Rinse with water applied by low-pressure spray to remove mold, mildew, and algae remover and soil.
5. Repeat cleaning procedure above where required to produce cleaning effect established by mockup.

D. Nonacidic Gel Chemical Cleaning:

1. Wet surface with water applied by low-pressure spray.
2. Apply gel cleaner in 1/8-inch (3-mm) thickness by brush, working into joints and crevices. Apply quickly and do not brush out excessively, so area is uniformly covered with fresh cleaner and dwell time is uniform throughout area being cleaned.
3. Rinse with water applied by low-pressure spray to remove chemicals and soil.
4. Repeat cleaning procedure above where required to produce cleaning effect established by mockup. Do not repeat more than once. If additional cleaning is required, use steam cleaning.

3.6 FINAL CLEANING

- A. Clean adjacent non-masonry surfaces of spillage and debris. Use detergent and soft brushes or cloths.
- B. Remove masking materials, leaving no residues that could trap dirt.

END OF SECTION 040110

SECTION 040120 - BRICK MASONRY REPAIR

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:
 - 1. Repairing brick masonry, including removal and reinstallation of units, where indicated.
 - 2. Point and repointing joints with mortar in areas indicated.
 - 3. Replacement of sealant at control and expansion joints. Refer to Division 7 Section – Sealants.
 - 4. Installation of new masonry weeps at base of wall, where indicated.

1.3 UNIT PRICING

- A. Include unit pricing for various types of brick masonry repair work as outlined in Section 012200 - Unit Prices.
- B. Indicate unit pricing on Bid Form.

1.4 DEFINITIONS

- A. Rebuilding (Setting) Mortar: Mortar used to set and anchor masonry in a structure, distinct from pointing mortar installed after masonry is set in place.

1.5 SEQUENCING AND SCHEDULING

- A. Work Sequence: Perform brick masonry repair work in the following sequence, which includes work specified in this and other Sections:
 - 1. Inspect masonry for open mortar joints and point them before cleaning to prevent the intrusion of water and other cleaning materials into the wall.
 - 2. Remove paint.
 - 3. Clean masonry.
 - 4. Rake out mortar from joints surrounding masonry to be replaced and from joints adjacent to masonry repairs along joints.
 - 5. Point mortar and sealant joints.
 - 6. After repairs and repointing have been completed and cured, perform a final cleaning to remove residues from this work.

1.6 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Samples for Initial Selection: For the following:
 - 1. Mortar: Submit sets of mortar that will be left exposed in the form of sample mortar strips. Match existing mortar.

1.7 QUALITY ASSURANCE

- A. Brick Masonry Repair Specialist Qualifications: Engage an experienced brick masonry repair firm to perform work of this Section. Firm shall have completed work similar in material, design, and extent to that indicated for this Project with a record of successful in-service performance. Experience in only installing masonry is insufficient experience for masonry repair work.
- B. Comply with recommendations from the Brick Industry Association (BIA) standards for work specified.
- C. Mockups: Prepare mockup of brick masonry repair to demonstrate aesthetic effects and to set quality standards for materials and execution and for fabrication and installation.
 - 1. Include brick removal and replacement, repointing, crack repair, weep installation and sealant joint replacement in mockup.
 - 2. Select location and submit to Architect for review.

1.8 FIELD CONDITIONS

- A. Weather Limitations: Proceed with installation only when existing and forecasted weather conditions permit brick masonry repair work to be performed according to product manufacturers' written instructions and specified requirements.

PART 2 - PRODUCTS

2.1 MATERIALS, GENERAL

- A. Source Limitations: Obtain each type of material for repairing brick masonry (brick, cement, sand, etc.) from single source with resources to provide materials of consistent quality in appearance and physical properties.

2.2 MASONRY MATERIALS

- A. Face Brick: As required to complete brick masonry repair work.
 - 1. Brick Matching Existing: Units with surface texture, size, and shape that match existing brickwork.
 - a. After completion of masonry repair, the existing dark color brick veneer as well as the newly repaired and repointed areas will be coated with a mineral pigment paint system.

2. Replacement brick shall be Type FBS or FBX; Grade SW type, and shall meet appearance and texture requirements.
 - a. Demonstrate appearance of replacement brick in specified mock up location.

2.3 MORTAR MATERIALS

- A. Portland Cement: ASTM C 150/C 150M, Type I or Type II, except Type III may be used for cold-weather construction; white or gray, where required for color matching of mortar.
- B. Mortar Sand: ASTM C 144.
 1. Exposed Mortar: Match size, texture, and gradation of existing mortar sand as closely as possible. Blend several sands if necessary to achieve suitable match.
- C. Water: Potable.

2.4 MORTAR MIXES

- A. Measurement and Mixing: Measure cementitious materials and sand in a dry condition by volume or equivalent weight. Do not measure by shovel; use known measure. Mix materials in a clean, mechanical batch mixer.

2.5 WEEP HOLES

- A. Provide manufactured weeps for installation at base of existing brick veneer at locations indicated.
 1. Weep holes placed at head joint in brick at the lowest point in wall, just above base flashing.

PART 3 - EXECUTION

3.1 PROTECTION

- A. Prevent mortar from staining face of surrounding masonry and other surfaces.
 1. Cover sills, ledges, and other projecting items to protect them from mortar droppings.
 2. Keep wall area wet below rebuilding and repair work to discourage mortar from adhering.
 3. Immediately remove mortar splatters in contact with exposed masonry and other surfaces.

3.2 MASONRY REPAIR, GENERAL

- A. Appearance Standard: Repaired surfaces are to have a uniform appearance as viewed from 30 feet away by Architect.

3.3 BRICK REMOVAL AND REPLACEMENT

- A. At locations indicated, carefully remove existing bricks in preparation for reinstallation. Carefully remove entire units from joint to joint, without damaging surrounding masonry, in a manner that permits reinstallation.
- B. Support and protect remaining masonry that surrounds removal area.
- C. Maintain flashing, reinforcement, lintels, and adjoining construction in an undamaged condition.
- D. Notify Architect of unforeseen detrimental conditions including voids, cracks, bulges, and loose units in existing masonry backup, rotted wood, rusted metal, and other deteriorated items.
- E. Remove in an undamaged condition as many whole bricks as possible.
 - 1. Remove mortar, loose particles, and soil from brick by cleaning with hand chisels, brushes, and water.
 - 2. Remove sealants by cutting close to brick with utility knife and cleaning with solvents.
- F. Clean masonry surrounding removal areas by removing mortar, dust, and loose particles in preparation for brick replacement.
- G. Maintain joint width for replacement units to match existing joints.
- H. Lay replacement brick with rebuilding (setting) mortar and with completely filled bed, head, and collar joints. Butter ends with enough mortar to fill head joints and shove into place.
 - 1. Tool exposed mortar joints in repaired areas to match joints of surrounding existing brickwork.
- I. Curing: Cure mortar by maintaining in thoroughly damp condition for at least 72 consecutive hours, including weekends and holidays.

3.4 REPOINTING

- A. Rake out and repoint joints in areas indicated to the following extent:
 - 1. Joints indicated as sealant-filled joints.
 - 2. Joints at locations of the following defects:
 - a. Holes and missing mortar.
 - b. Cracks that can be penetrated 1/4 inch or more by a knife blade.
 - c. Cracks 1/16 inch or more in width and of any depth.
 - d. Hollow-sounding joints when tapped by metal object.
 - e. Eroded surfaces 1/4 inch or more deep.
 - f. Deterioration to point that mortar can be easily removed by hand, without tools.
 - g. Joints filled with substances other than mortar.
- B. Do not rake out and repoint joints where not required.
- C. Notify Architect of other unforeseen detrimental conditions including voids in mortar joints, cracks, loose masonry units, rotted wood, rusted metal, and other deteriorated items.

D. Pointing with Mortar:

1. Rinse joint surfaces with water to remove dust and mortar particles. Time rinsing application so, at time of pointing, joint surfaces are damp but free of standing water. If rinse water dries, dampen joint surfaces before pointing.
2. Apply pointing mortar first to areas where existing mortar was removed to depths greater than surrounding areas. Apply in layers not greater than 3/8 inch until a uniform depth is formed. Fully compact each layer, and allow it to become thumbprint hard before applying next layer.
3. After deep areas have been filled to same depth as remaining joints, point joints by placing mortar in layers not greater than 3/8 inch. Fully compact each layer and allow to become thumbprint hard before applying next layer. Where existing masonry units have worn or rounded edges, slightly recess finished mortar surface below face of masonry to avoid widened joint faces. Take care not to spread mortar beyond joint edges onto exposed masonry surfaces or to featheredge the mortar.
4. When mortar is thumbprint hard, tool joints to match original appearance of joints as demonstrated in approved mockup. Remove excess mortar from edge of joint by brushing.
5. Cure mortar by maintaining in thoroughly damp condition for at least 72 consecutive hours, including weekends and holidays.
6. Hairline cracking within mortar or mortar separation at edge of a joint is unacceptable. Completely remove such mortar and repoint.

3.5 WEEP HOLE INSTALLATION

- A. At existing brick locations indicated install new brick weep holes and manufactured weep tubes in the head joint of brick, just above base flashing.
- B. Carefully drill new 3/8" diameter holes to accommodate weep tube installation. Do not drill through or damage existing base flashing. Limit depth of drilling to thickness of existing brick veneer.
- C. Space new weeps at no more than 24" on center.

3.6 FINAL CLEANING

- A. After mortar has fully hardened, thoroughly clean exposed masonry surfaces of excess mortar and foreign matter; use wood scrapers, stiff-nylon or -fiber brushes, and clean water applied by low-pressure spray.

END OF SECTION 040120

SECTION 042200 - CONCRETE UNIT MASONRY

PART 1 - GENERAL

When the information in this Specification Section conflicts with information on the Structural Construction Drawings, the Structural Construction Drawings shall prevail.

1.1 SUMMARY

- A. Section Includes:
 - 1. Concrete masonry units.
 - 2. Mortar and grout.
 - 3. Masonry Lintels
 - 4. Steel reinforcing bars.
 - 5. Masonry-joint reinforcement.
 - 6. Miscellaneous masonry accessories.

1.2 DEFINITIONS

- A. *Area, gross cross-sectional* - The area delineated by the out-to-out dimensions of masonry in the plane under consideration.
- B. *Area, net cross-sectional* - The area of masonry units, grout, and mortar crossed by the plane under consideration based on out-to-out dimensions.
- C. *Bond Beam* - A horizontal, sloped, or stepped element that is fully grouted, has longitudinal bar reinforcement, and is constructed within a masonry wall.
- D. *Cleanouts* - Openings that are sized and spaced to allow removal of debris from the bottom of the grout space.
- E. *Collar joint* - Vertical longitudinal space between wythes of masonry or between masonry and back up construction, which is permitted to be filled with mortar or grout.
- F. *Compressive strength of masonry* - Maximum compressive force resisted per unit of net cross-sectional area of masonry, determined by testing masonry prisms; or a function of individual masonry units, mortar and grout in accordance with the provisions of this Specification.
- G. *Dimension, nominal* - The specified dimension plus an allowance for the joints with which the units are to be laid. Nominal dimensions are usually stated in whole numbers. Thickness is given first, followed by height and then length.
- H. *Dimensions, specified* - Dimensions specified for the manufacture or construction of a unit, joint, or element.
- I. *Grout* - (1) A plastic mixture of cementitious materials, aggregates, and water, with or without admixtures, initially produced to pouring consistency without segregation of the constituents during placement. (2) The hardened equivalent of such mixtures.
- J. *Grout, self-consolidating* - A highly fluid and stable grout typically with admixtures, that remains homogeneous when placed and does not require puddling or vibration for consolidation.

- K. *Grout lift* - An increment of grout height within a total grout pour. A grout pour consists of one or more grout lifts.
- L. *Grout pour* — The total height of masonry to be grouted prior to erection of additional masonry. A grout pour consists of one or more grout lifts.
- M. *Inspection, continuous* — The Inspection Agency's full-time observation of work by being present in the area where the work is being performed.
- N. *Inspection, periodic* — The Inspection Agency's part-time or intermittent observation of work during construction by being present in the area where the work has been or is being performed, and observation upon completion of the work.
- O. *Mean daily temperature* — The average daily temperature of temperature extremes predicted by a local weather bureau for the next 24 hours.
- P. *Minimum daily temperature* — The low temperature forecast by a local weather bureau to occur within the next 24 hours.
- Q. *Minimum/maximum (not less than . . . not more than)* — Minimum or maximum values given in this Specification are absolute. Do not construe that tolerances allow lowering a minimum or increasing a maximum.
- R. *Partition wall* — An interior wall without structural function.
- S. *Prism* – An assemblage of masonry units and mortar, with or without grout, used as a test specimen for determining properties of the masonry.
- T. *Project Drawings* — The Drawings that, along with the Project Specifications, complete the descriptive information for constructing the Work required or referred to in the Contract Documents.
- U. *Quality assurance* — The administrative and procedural requirements established by the Contract Documents to assure that constructed masonry is in compliance with the Contract Documents.
- V. *Reinforced Masonry*: Masonry containing reinforcing steel in grouted cells.
- W. *Running bond* — The placement of masonry units such that head joints in successive courses are horizontally offset at least one-quarter the unit length.
- X. *Slump flow* — The circular spread of plastic self- consolidating grout, which is evaluated in accordance ASTM C1611.
- Y. *Specified compressive strength of masonry, $f'm$* — Minimum compressive strength, expressed as force per unit of net cross-sectional area, required of the masonry used in construction by the Project Specifications or Project Drawings, and upon which the project design is based.
- Z. *Stack bond* — For the purpose of this Specification, stack bond is other than running bond. Usually the placement of masonry units is such that head joints in successive courses are vertically aligned.
- AA. *Visual stability index (VSI)* — An index, defined in ASTM C1611, that qualitatively indicates the stability of self-consolidating grout
- BB. *Wall, loadbearing* — A wall supporting vertical loads greater than 200 lb per lineal foot (2919 N/m) in addition to its own weight.

- CC. *Wall, masonry bonded hollow* — A multiwythe wall built with masonry units arranged to provide an air space between the wythes and with the wythes bonded together with masonry units.
- DD. *Wythe* — Each continuous vertical section of a wall, one masonry unit in thickness. CMU(s): Concrete masonry unit(s).

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product including, but not limited to, rebar positioners, rebar couplers, other masonry accessories.
- B. Mix Designs: For each type of mortar and grout.
 - 1. For each mortar mix:
 - a. Mix designs indicating type and proportions of ingredients in compliance with the proportion specification of ASTM C270
 - b. Test according to ASTM C 1506 for water retention, and ASTM C 91 for air content.
 - 2. b. One of the following for each grout mix:
 - a. Mix designs indicating type and proportions of the ingredients according to the proportion requirements of ASTM C476, or
 - b. Mix designs and grout strength test performed in accordance with ASTM C476
- C. Shop Drawings: For the following:
 - 1. Masonry Units: Show sizes, profiles, coursing, and locations of special shapes.
 - 2. Reinforcing Steel:
 - a. Show elevations of reinforced walls.
 - b. Coordinate openings (doors, windows, mechanical duct penetrations, etc.) with Architectural and Mechanical drawings. Show jamb reinforcing at openings.
- D. Submittals requiring more than TWO (2) reviews by SMA resulting from errors and omissions of the supplier's detailer will be an Additional Service and invoiced at an hourly rate. An invoice for these services will be attached to the final approved set of shop drawings.

1.4 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For testing agency.
- B. Material Certificates: For each type and size of the following:
 - 1. Masonry units.
 - a. Include data on material properties referencing the correct strength of masonry (f' m) specified in the construction documents.
 - b. For masonry units used in structural masonry, include data and calculations establishing average net-area compressive strength of units.
 - 2. Cementitious materials. Include name of manufacturer, brand name, and type.
 - 3. Mortar admixtures.
 - 4. Preblended, dry mortar mixes. Include description of type and proportions of ingredients.
 - 5. Grout mixes. Include description of type and proportions of ingredients.
 - 6. Joint reinforcement.
 - 7. Anchors, ties, and metal accessories, including reinforcing bar positioners.
- C. Statement of Compressive Strength of Masonry: For each combination of masonry unit type and mortar type, provide statement of average net-area compressive strength of masonry units, mortar type, and resulting net-area compressive strength of masonry determined according to Table 2 in TMS 602/ACI 530.1/ASCE 6.

- D. Cold-Weather and Hot-Weather Procedures: Detailed description of methods, materials, and equipment to be used to comply with requirements.
- E. Coordination Drawings
 - 1. The Construction Manager, General Contractor, and MEP Contractors shall locate on the Masonry Shop Drawing Wall Elevations the locations of necessary MEP openings. The masonry contractor shall allow for enough reinforcing (including full length wall reinforcing) to satisfy the requirements regarding minimum reinforcing around wall openings.
 - 2. A final copy of the wall elevations indicating the MEP openings shall be provided to the masonry contractor, all applicable MEP trades, and a record set copy to Shell + Meyer Associates, Inc.
 - 3. The above coordination items shall be completed before the CMU wall has been placed to the lower elevation of the required openings.
 - a. If the required MEP opening is installed without the above coordination items having taken place, the contractor shall be responsible for additional design fees that may result from redesign or to provide additional reinforcing details.

1.5 QUALITY ASSURANCE

- A. Testing Agency Qualifications: Qualified according to ASTM C 1093 for testing indicated.
- B. Testing Agency's services and duties
 - 1. Sample and test in accordance with the Special Inspection requirements noted on the Structural Drawings, as specified for the project.
 - 2. Unless otherwise required, report test results to the Architect/Engineer, Inspection Agency, and Contractor promptly after they are performed. Include in test reports a summary of conditions under which test specimens were stored prior to testing and state what portion of the construction is represented by each test.
 - 3. When there is reason to believe that any material furnished or work performed by the Contractor fails to fulfill the requirements of the Contract Documents, report such deficiency to the Architect/Engineer, Inspection Agency, and Contractor.
 - 4. Unless otherwise required, the Owner will retain the Testing Agency.
- C. Inspection Agency's services and duties
 - 1. Inspect and evaluate in accordance with the Special Inspection requirements noted on the Structural Drawings, as specified for the project.
 - 2. Unless otherwise required, report inspection results to the Architect/Engineer, and Contractor promptly after they are performed. Include in inspection reports a summary of conditions under which the inspections were made and state what portion of the construction is represented by each inspection.
 - 3. Furnish inspection reports to the Architect/Engineer and Contractor in a timely manner.
 - 4. When there is reason to believe that any material furnished or work performed by the Contractor fails to fulfill the requirements of the Contract Documents, report such deficiency to the Architect/Engineer and to the Contractor immediately.
 - 5. Submit a final signed report stating whether the Work requiring inspection was, to the best of the Inspection Agency's knowledge, in conformance. Submit the final report to the Architect/Engineer and Contractor.
 - 6. Unless otherwise required, the Owner will retain the Inspection Agency.
- D. Contractor's services and duties
 - 1. Permit and facilitate access to the construction sites and the performance of activities for quality assurance by the Testing and Inspection Agencies.
 - 2. The use of testing and inspection services does not relieve the Contractor of the responsibility to furnish materials and construction in full compliance.
 - 3. To facilitate testing and inspection, comply with the following:

- a. Furnish necessary labor to assist the designated testing agency in obtaining and handling samples at the Project.
 - b. Advise the designated Testing Agency and Inspection Agency sufficiently in advance of operations to allow for completion of quality assurance measures and for the assignment of personnel.
 - c. Provide masonry materials required for preconstruction and construction testing.
4. Provide and maintain adequate facilities for the sole use of the testing agency for safe storage and proper curing of test specimens on the Project Site.
 5. In the submittals, include the results of testing performed to qualify the materials and to establish mix designs.
- E. Grout demonstration panel - Prior to masonry construction, construct a grout demonstration panel if proposed grouting procedures, construction techniques, and grout space geometry do not conform to the *Confinement, Grout Pour Height, and Grout Lift Height* requirements specified in Part 3 of this specification.

1.6 DELIVERY, STORAGE, AND HANDLING

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

1.7 PROJECT CONDITIONS

- A. Protection of Masonry: During construction, cover tops of walls, projections, and sills with waterproof sheeting at end of each day's work. Cover partially completed masonry when construction is not in progress.
 1. Extend cover a minimum of 24 inches down both sides of walls, and hold cover securely in place.
- B. Do not apply uniform floor or roof loads for at least 12 hours and concentrated loads for at least three days after building masonry walls or columns.
- C. Construction loads - Do not apply construction loads that exceed the safe superimposed load capacity of the masonry and shores, if used.
- D. Stain Prevention: Prevent grout, mortar, and soil from staining the face of masonry to be left exposed or painted. Immediately remove grout, mortar, and soil that come in contact with such masonry.

1. Protect base of walls from rain-splashed mud and from mortar splatter by spreading coverings on ground and over wall surface.
 2. Protect sills, ledges, and projections from mortar droppings.
 3. Protect surfaces of window and door frames, as well as similar products with painted and integral finishes, from mortar droppings.
 4. Turn scaffold boards near the wall on edge at the end of each day to prevent rain from splashing mortar and dirt onto completed masonry.
- E. Cold weather construction - When ambient air temperature is below 40°F , implement cold weather procedures and comply with the following:
1. Preparation - Comply with the following requirements prior to conducting masonry work:
 - a. Do not lay masonry units having either a temperature below 20°F or containing frozen moisture, visible ice, or snow on their surface.
 - b. Remove visible ice and snow from the top surface of existing foundations and masonry to receive new construction. Heat these surfaces above freezing, using methods that do not result in damage.
 2. Construction - These requirements apply to work in progress and are based on ambient air temperature. Do not heat water or aggregates used in mortar or grout above 140°F Comply with the following requirements when the following ambient air temperatures exist:
 - a. 40°F to 32°F : Heat sand or mixing water to produce mortar temperature between 40°F and 120°F at the time of mixing. Grout does not require heated materials, unless the temperature of the materials is below 32°F .
 - b. Below 32°F to 25°F : Heat sand and mixing water to produce mortar temperature between 40°F and 120°F at the time of mixing. Maintain mortar temperature above freezing until used in masonry. Heat grout aggregates and mixing water to produce grout temperature between 70°F and 120°F at the time of mixing. Maintain grout temperature above 70°F at the time of grout placement.
 - c. Below 25°F to 20°F : Comply with Item 'b' requirements above and the following: Heat masonry surfaces under construction to 40°F and use wind breaks or enclosures when the wind velocity exceeds 15 mph. Heat masonry to a minimum of 40°F prior to grouting.
 - d. Below 20°F : Comply with Item 'c' requirements and the following: Provide an enclosure and auxiliary heat to maintain air temperature above 32°F within the enclosure.
 3. Protection - These requirements apply after masonry is placed and are based on anticipated minimum daily temperature for grouted masonry and anticipated mean daily temperature for ungrouted masonry. Protect completed masonry in the following manner:
 - a. Maintain the temperature of glass unit masonry above 40°F for the first 48 hr after construction.
 - b. 40°F to 25°F : Protect newly constructed masonry by covering with a weather-resistive membrane for 24 hr after being completed.
 - c. Below 25°F to 20°F : Cover newly constructed masonry completely with weather-resistive insulating blankets, or equal protection, for 48 hr after completion of work.
 - d. Below 20°F : Maintain newly constructed masonry temperature above 32°F for at least 48 hr after being completed by using heated enclosures, electric heating blankets, infrared lamps, or other acceptable methods.
 4. Cold-Weather Cleaning: Use liquid cleaning methods only when air temperature is 40°F and higher and will remain so until masonry has dried, but not less than seven days after completing cleaning.
- F. Hot weather construction — Implement approved hot weather procedures and comply with the following provisions:
1. Preparation — Prior to conducting masonry work:
 - a. When the ambient air temperature exceeds 100°F, or exceeds 90°F with a wind velocity greater than 8 mph:
 - 1) Maintain sand piles in a damp, loose condition.

- 2) Provide necessary conditions and equipment to produce mortar having a temperature below 120°F.
- b. When the ambient temperature exceeds 115°F, or exceeds 105°F with a wind velocity greater than 8 mph, implement the requirements of Item 1.a above and shade materials and mixing equipment from direct sunlight.
2. Construction — While masonry work is in progress:
 - a. When the ambient air temperature exceeds 100°F, or exceeds 90°F with a wind velocity greater than 8 mph:
 - 1) Maintain temperature of mortar and grout below 120°F.
 - 2) Flush mixer, mortar transport container, and mortar boards with cool water before they come into contact with mortar ingredients or mortar.
 - 3) Maintain mortar consistency by retempering with cool water.
 - 4) Use mortar within 2 hr of initial mixing.
 - b. When the ambient temperature exceeds 115°F, or exceeds 105°F with a wind velocity greater than 8 mph, implement the requirements of Item 2.a above and use cool mixing water for mortar and grout. Ice is permitted in the mixing water prior to use. Do not permit ice in the mixing water when added to the other mortar or grout materials.
3. Protection — When the mean daily temperature exceeds 100°F or exceeds 90°F with a wind velocity greater than 8 mph, fog spray newly constructed masonry until damp, at least three times a day until the masonry is three days old.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS – System Description

- A. Compressive strength requirements - Compressive strength of masonry in each masonry wythe and grouted collar joint shall equal or exceed the specified f 'm. For partially grouted masonry, the compressive strength of both the grouted and ungrouted masonry shall equal or exceed the specified f 'm.
- B. For compressive strength determination of concrete masonry use the unit strength method.
 1. Unit strength method
 - a. Use Table 1 to determine the compressive strength of concrete masonry based on the strength of the unit and type of mortar specified. The following must be met:
 - 1) Units are sampled and tested to verify conformance with ASTM C90.
 - 2) Thickness of bed joints does not exceed 5/8 in.
 - 3) For grouted masonry, the grout conforms to ASTM C476.

Table 1 — Compressive strength of masonry based on the compressive strength of concrete masonry units and type of mortar used in construction

Net area compressive strength of masonry, f 'm, psi	Net area compressive strength of concrete masonry units, psi		Minimum Grout Strength, psi (125% f 'm)
	Type M or S mortar	Type N mortar	
1700	--	1900	2125
1900	1900	2350	2375
2000	2000	2650	2500

2.2 MANUFACTURERS

- A. Source Limitations for Masonry Units: Obtain units of a uniform texture and color, or a uniform blend within the ranges accepted for these characteristics, from single source from single manufacturer for each product required.
- B. Source Limitations for Mortar Materials: Obtain mortar ingredients of a uniform quality, including color, from single manufacturer for each cementitious component and from single source or producer for each aggregate.

2.3 UNIT MASONRY, GENERAL

- A. Masonry Standard: Comply with TMS 602/ACI 530.1/ASCE 6 except as modified by requirements in the Contract Documents.
- B. Defective Units: Referenced masonry unit standards may allow a certain percentage of units to contain chips, cracks, or other defects exceeding limits stated. Do not use units where such defects are exposed in the completed Work.
- C. Fire-Resistance Ratings: Comply with requirements for fire-resistance-rated assembly designs indicated.
 - 1. Where fire-resistance-rated construction is indicated, units shall be listed and labeled by a qualified testing agency acceptable to authorities having jurisdiction.

2.4 CONCRETE MASONRY UNITS

- A. Regional Materials: CMUs shall be manufactured within 500 miles of Project site from aggregates and cement that have been extracted, harvested, or recovered, as well as manufactured, within 500 miles of Project site.
- B. Shapes: Provide shapes indicated and as follows, with exposed surfaces matching exposed faces of adjacent units unless otherwise indicated.
 - a. Provide special shapes for lintels, corners, jambs, sashes, movement joints, headers, bonding, and other special conditions.
 - 1) Provide nominal 4 inch solid units at all steel beam and joist pockets located in firewalls to maintain fire rating.
 - 2. Provide square-edged units for outside corners unless otherwise indicated.
- C. CMUs: ASTM C 90.
 - 1. Unit Compressive Strength: Provide units with minimum average net-area compressive strength of 2000 psi.
 - 2. Density Classification: Normal weight unless otherwise indicated.
 - 3. Size (Width): Manufactured to dimensions 3/8 inch less-than-nominal dimensions.
 - 4. Exposed Faces: Provide color and texture matching the range represented by Architect's sample.
 - 5. Solid units used in firewalls shall not contain calcium carbonate or sand gravel.

2.5 CONCRETE AND MASONRY LINTELS

- A. Concrete Lintels: Precast or formed-in-place concrete lintels complying with requirements in Section 03 30 41 "Precast Structural Concrete" and Section 03 30 00 "Cast-in-Place Concrete," with reinforcing bars indicated in the Drawing Schedules. Cure precast lintels before handling and installing.
 - 1. Precast Concrete Lintels will not be permitted to be substituted with Masonry Lintels.
- B. Masonry Lintels: Prefabricated or built-in-place masonry lintels made from bond beam CMUs matching adjacent CMUs in color, texture, and density classification, with reinforcing bars placed as indicated and filled with coarse grout. Temporarily support built-in-place lintels until cured.

2.6 MORTAR MATERIALS

- A. Regional Materials: Aggregate for mortar and grout shall be extracted, harvested, or recovered, as well as manufactured, within 500 miles of Project site.
- B. Provide mortar of the type and color specified, and conforming with ASTM C270.
- C. Portland Cement: ASTM C 150, Type I or II, except Type III may be used for cold-weather construction. Provide natural color or white cement as required to produce mortar color indicated.
 - 1. Alkali content shall not be more than 0.1 percent when tested according to ASTM C 114.
- D. Hydrated Lime: ASTM C 207, Type S.
- E. Portland Cement-Lime Mix: Packaged blend of portland cement and hydrated lime containing no other ingredients.
- F. Aggregate for Mortar: ASTM C 144.
 - 1. For mortar that is exposed to view, use washed aggregate consisting of natural sand or crushed stone.
 - 2. For joints less than 1/4 inch thick, use aggregate graded with 100 percent passing the No. 16 sieve.
 - 3. White-Mortar Aggregates: Natural white sand or crushed white stone.
 - 4. Colored-Mortar Aggregates: Natural sand or crushed stone of color necessary to produce required mortar color.
- G. Cold-Weather Admixture: Nonchloride, noncorrosive, accelerating admixture complying with ASTM C 494, Type C, and recommended by manufacturer for use in masonry mortar of composition indicated.

- H. Water: Potable.

2.7 GROUT MATERIALS

- A. Unless otherwise required, provide grout that conforms to the requirements of ASTM C476
- B. Provide grout compressive strength that equals or exceeds 125% of f'_m . Determine compressive strength of grout in accordance with ASTM C1019.

- C. Do not use admixtures unless acceptable. Field addition of admixtures is not permitted in self-consolidating grout.
- D. Aggregate for Grout: ASTM C 404.
- E. Water: Potable.

2.8 REINFORCEMENT

- A. Uncoated Steel Reinforcing Bars: ASTM A 615 or ASTM A 996, Grade 60.
 - 1. Fabrication
 - a. Fabricate reinforcing bars in accordance with the fabricating tolerances of ACI 117.
 - b. Bar Size No.6 and Greater: Provide standard threaded ends for mechanical coupler attachment. Coupler specification may require tapered threads.
 - c. Unless otherwise required, bend bars cold and do not heat bars.
 - d. The minimum inside diameter of bend for stirrups shall be five bar diameters.
 - e. The minimum inside bend diameter for other bars is as follows:
 - 1) No. 3 through No. 8 - 6 bar diameters
 - 2) No. 9 through No. 11 - 8 bar diameters
 - f. Provide standard hooks that conform to the following:
 - 1) A standard 180-degree hook: 180-degree bend plus a minimum extension of 4 bar diameters or 2 1/2 in., whichever is greater.
 - 2) A standard 90-degree hook: 90-degree bend plus a minimum extension of 12 bar diameters.
 - 3) For stirrups and tie hooks for a No. 5 bar and smaller: a 90- or 135-degree bend plus a minimum of 6 bar diameters or 2 1/2 in., whichever is greater.
- B. Masonry-Joint Reinforcement, General: Ladder type complying with ASTM A 951.
 - 1. Interior Walls: Hot-dip galvanized carbon steel.
 - 2. Exterior Walls: Hot-dip galvanized carbon steel.
 - 3. Wire Size for Side Rods: 0.148-inch diameter.
 - 4. Wire Size for Cross Rods: 0.148-inch diameter.
 - 5. Maximum spacing of cross wires in ladder- type joint reinforcement and of points of connection of cross wires to longitudinal wires of truss-type joint reinforcement shall be 16 in.
 - 6. Provide in lengths of not less than 10 feet, with prefabricated corner and tee units.

2.9 TIES AND ANCHORS

- A. General: Ties and anchors shall extend at least 1-1/2 inches into masonry but with at least a 5/8-inch cover on outside face.
- B. Materials: Provide ties and anchors specified in this article that are made from materials that comply with the following unless otherwise indicated:
 - 1. Hot-Dip Galvanized, Carbon-Steel Wire: ASTM A 82, with ASTM A 153, Class B-2 coating (1.50 oz/ft²)
 - 2. Steel Sheet, Galvanized after Fabrication: ASTM A 1008, Commercial Steel, with ASTM A 153, Class B coating.
 - 3. Steel Plates, Shapes, and Bars: ASTM A 36.
 - 4. Headed anchor bolts - ASTM A307, Grade A
- C. Post Installed Anchors: As indicated on the Contract Drawings or in Section 05 05 23 "Post-Installed Anchors"

2.10 MASONRY ACCESSORIES

- A. Preformed Control-Joint Gaskets: Provide contraction (shrinkage) joint material made from styrene-butadiene-rubber compound, complying with ASTM D 2000, Designation M2AA-805 or PVC, complying with ASTM D 2287, Type PVC-654-4 and designed to fit standard sash block and to maintain lateral stability in masonry wall; size and configuration as indicated.
- B. Compressible Expansion Joint Filler: Premolded filler strips complying with ASTM D 1056, Grade 2A1; compressible up to 35 percent; of width and thickness indicated; formulated from neoprene urethane or PVC.
- C. Bond-Breaker Strips: Asphalt-saturated felt complying with ASTM D 226, Type I (No. 15 asphalt felt).
- D. Mechanical Reinforcing Couplers for Threaded-Deformed Rebar: Designed to produce a full strength mechanical joint between reinforcing bars, replacing the need for lap splices.
 - 1. Reinforcement to splice connection shall meet or exceed 125% of the specified tensile strength of the rebar.
 - 2. Products: Subject to compliance with requirements. Do NOT use flanged or donut style couplers. Provide one of the following:
 - a. BarSplice Products, Inc.: BPI BARSPLICER POSITION COUPLER
 - b. Dayton Superior Corporation: TAPER LOCK Standard Coupler
 - c. Erico: Lenton Mason LockNote above product requires tapered threads at reinforcing ends
 - d. Dywidag Systems International: GEWI Threadbar System Static Coupler

- e. BarSplice Products, Inc.: BARGRIP Standard Type 1 Series – Cold-swaged steel coupling sleeve type, which shall be installed by octagonal dies
 - 1) Use only BPI swaging equipment for proper installation of swaged couplers
 - 3. Mechanical couplers required in lieu of laps for all reinforcing bars No. 6 and greater, no exceptions taken.
 - 4. Parts shall be manufactured to the quality requirements of ISO 9001
 - E. Reinforcing Bar Positioners: Wire units designed to fit into mortar bed joints spanning masonry unit cells and to hold reinforcing bars in center of cells. Units are formed from 0.148-inch steel wire, hot-dip galvanized after fabrication. Provide units designed for number of bars indicated.
 - 1. Products
 - a. Dayton Superior Corporation, Dur-O-Wal Division ; D/A 810, D/A 812 or D/A 817
 - b. Heckman Building Products, Inc. ; No. 376 Rebar Positioner
 - c. Hohman & Barnard, Inc. ; #RB or #RB – Twin Rebar Positioner
 - d. Wire-Bond ; O-Ring or Double O-Ring Rebar Positioner
 - F. Masonry cleaner
 - 1. Use potable water and detergents to clean masonry unless otherwise acceptable.
 - 2. Unless otherwise required, do not use acid or caustic solutions.
- 2.11 MORTAR AND GROUT MIXES
- A. General: Do not use admixtures, including pigments, air-entraining agents, accelerators, retarders, water-repellent agents, antifreeze compounds, or other admixtures unless otherwise indicated.
 - 1. Do not use calcium chloride in mortar or grout.
 - 2. Use portland cement-lime or mortar cement mortar.
 - 3. Do not use masonry cement
 - 4. Add cold-weather admixture (if used) at same rate for all mortar that will be exposed to view, regardless of weather conditions, to ensure that mortar color is consistent.
 - B. Preblended, Dry Mortar Mix: Furnish dry mortar ingredients in form of a preblended mix. Measure quantities by weight to ensure accurate proportions, and thoroughly blend ingredients before delivering to Project site.
 - C. Mortar for Unit Masonry: Comply with ASTM C 270, Proportion Specification. Provide the following types of mortar for applications stated unless another type is indicated or needed to provide required compressive strength of masonry.
 - 1. For masonry below grade or in contact with earth, use Type S.

2. For reinforced masonry, use Type N.
3. For mortar parge coats, use Type N to match bedding.
4. For exterior, above-grade, load-bearing and nonload-bearing walls and parapet walls; for interior load-bearing walls; and for other applications where another type is not indicated, use Type N.
5. For interior nonload-bearing partitions, Type N.

D. Mortar Mixing

1. Mix cementitious materials and aggregates between 3 and 5 minutes in a mechanical batch mixer with a sufficient amount of water to produce a workable consistency. Unless acceptable, do not hand mix mortar. Maintain workability of mortar by remixing or retempering. Discard mortar which has begun to stiffen or is not used within 2 1/2 hr after initial mixing.
2. Limit the weight of mineral oxide or carbon black pigments added to project-site prepared mortar to the following maximum percentages by weight of cement:
 - a. Pigmented portland cement-lime mortar
 - 1) Mineral oxide pigment 10 percent
 - 2) Carbon black pigment 2 percent
 - b. Pigmented mortar cement mortar
 - 1) Mineral oxide pigment 5 percent
 - 2) Carbon black pigment 1 percent
3. Do not use admixtures containing more than 0.2 percent chloride ions.

E. Grout for Unit Masonry: Comply with ASTM C 476.

1. Use grout of type indicated or, if not otherwise indicated, of type (fine or coarse) that will comply with TMS 602/ACI 530.1/ASCE 6 for dimensions of grout spaces and pour height.
2. Proportion grout in accordance with ASTM C 476, Table 1 or paragraph 4.2.2 for specified 28-day compressive strength.
3. Provide grout with a slump of 8 to 11 inches as measured according to ASTM C 143.
4. Maximum compressive strength of grout to be 5,000 psi.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

- B. For the record, prepare written report, endorsed by Installer, listing conditions detrimental to performance of the Work.
- C. Verify that foundations are constructed within a level alignment tolerance of +/- 1/2 in.
- D. Verify that reinforcing dowels are positioned in accordance with the Project Drawings.
 - a. Masonry shear wall end zone reinforcing dowels are cast-in place
- E. Before installation, examine rough-in and built-in construction for piping systems to verify actual locations of piping.
- F. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Clean reinforcement and shanks of anchor bolts by removing mud, oil, or other materials that will adversely affect or reduce bond at the time mortar or grout is placed. Reinforcement with rust, mill scale, or a combination of both are acceptable without cleaning or brushing provided the dimensions and weights, including heights of deformations, of a cleaned sample are not less than required by the ASTM specification covering this reinforcement in this Specification.
- B. Prior to placing masonry, remove laitance, loose aggregate, and anything else that would prevent mortar from bonding to the foundation.
- C. Wetting masonry units
 - 1. Concrete masonry - Unless otherwise required, do not wet concrete masonry units before laying. Wet cutting is permitted.
- D. Debris - Construct grout spaces free of mortar dropping, debris, loose aggregates, and any material deleterious to masonry grout.
- E. Reinforcement - Place reinforcement, rebar positioners, and ties in grout spaces prior to grouting.
- F. Cleanouts - Provide cleanouts in the bottom course of masonry for each grout pour when the grout pour height exceeds 5 ft 4 in.
 - 1. Construct cleanouts so that the space to be grouted can be cleaned and inspected. In solid grouted masonry, space cleanouts horizontally a maximum of 32 in on center.
 - 2. Construct cleanouts with an opening of sufficient size to permit removal of debris. The minimum opening dimension shall be 3 in.
 - 3. After cleaning, close cleanouts with closures braced to resist grout pressure.

3.3 INSTALLATION, GENERAL

- A. Build chases and recesses to accommodate items specified in this and other Sections.
- B. Coordinate beam and joist pockets with the final approved Steel Embed shop drawing.

- C. Leave openings for equipment to be installed before completing masonry. After installing equipment, complete masonry to match construction immediately adjacent to opening.
- D. Construct chases as masonry units are laid.
- E. Install pipes and conduits passing horizontally through nonbearing masonry partitions.
- F. Do not place pipes and conduits passing horizontally through piers, pilasters, or columns, unless detailed on structural contract documents.
- G. Limit horizontal runs of conduit in and parallel to plane of walls to 16 inches.
- H. Install and secure connectors, flashing, weep holes, weep vents, nailing blocks, and other accessories.
- I. Install movement joints.
- J. Aluminum — Do not embed aluminum conduits, pipes, and accessories in masonry, grout, or mortar, unless effectively coated or covered to prevent chemical reaction between aluminum and cement or electrolytic action between aluminum and steel.
- K. Do not place dissimilar metals in contact with each other.
- L. Use full-size units without cutting if possible. If cutting is required to provide a continuous pattern or to fit adjoining construction, cut units with motor-driven saws; provide clean, sharp, unchipped edges. Allow units to dry before laying unless wetting of units is specified. Install cut units with cut surfaces and, where possible, cut edges concealed.

3.4 TOLERANCES

- A. Dimensions of Elements:
 - 1. For dimensions in cross section or elevation, do not vary by more than plus 1/2 inch or minus 1/4 inch.
 - 2. For grout space or cavity width, except for masonry walls passing framed construction, do not vary by more than plus 3/8 inch or minus 1/4 inch.
- B. Joints:
 - 1. For bed joints, do not vary from thickness indicated by more than plus or minus 1/8 inch, with a maximum thickness limited to 1/2 inch.
 - 2. For visible bed joints, do not vary from bed-joint thickness of adjacent courses by more than 1/8 inch.
 - 3. For bed joints between flashing and masonry, do not vary from bed-joint thickness by more than plus 1/8 inch or minus 1/2 inch. Mortar is not required when masonry is laid on top of flashing.
 - 4. For head and collar joints, do not vary from thickness indicated by more than plus 3/8 inch or minus 1/4 inch.
 - 5. For visible head joints, do not vary from adjacent bed-joint and head-joint thicknesses by more than plus or minus 1/8 inch.

6. For visible bed joints and head joints of stacked bond, do not vary from a straight line by more than 1/16 inch from one masonry unit to the next.

C. Lines and Levels:

1. For bed joints and top surfaces of bearing walls, do not vary from level by more than 1/4 inch in 10 feet, or 1/2-inch maximum.
2. For conspicuous horizontal lines, such as lintels, sills, parapets, and reveals, do not vary from level by more than 1/8 inch in 10 feet, 1/4 inch in 20 feet, or 1/2-inch maximum.
3. For vertical lines and surfaces, do not vary from plumb by more than 1/4 inch in 10 feet, 3/8 inch in 20 feet, or 1/2-inch maximum.
4. For conspicuous vertical lines, such as external corners, door jambs, reveals, and expansion and control joints, do not vary from plumb by more than 1/8 inch in 10 feet, 1/4 inch in 20 feet, or 1/2-inch maximum.
5. For lines and surfaces, do not vary from straight by more than 1/4 inch in 10 feet, 3/8 inch in 20 feet, or 1/2-inch maximum.
6. For vertical alignment of visible ends of walls, do not vary from plumb by more than 1/4 inch in 10 feet or 1/2-inch maximum.
7. For faces of adjacent visible masonry units, do not vary from flush alignment by more than 1/16 inch except due to warpage of masonry units within tolerances specified for warpage of units.

D. Locations of Elements:

1. For location of elements in plan, do not vary from that indicated by more than plus or minus 1/2 inch in 20 feet, or 3/4 inch maximum.
2. For location of elements in elevation, do not vary from that indicated by more than plus or minus 1/4 inch in a story height or 3/4 inch maximum.

3.5 LAYING MASONRY WALLS

- A. Bond pattern - Unless otherwise required, lay masonry in running bond; do not use units with less-than-nominal 4-inch horizontal face dimensions at corners or jambs.
- B. Lay out walls in advance for accurate spacing of surface bond patterns with uniform joint thicknesses and for accurate location of openings, movement-type joints, returns, and offsets. Avoid using less-than-half-size units, particularly at corners, jambs, and, where possible, at other locations.
 1. Refer to Coordination Drawing requirements in Part 1 of this Specification.
- C. Lay concealed masonry with all units in a wythe in running bond or bonded by lapping not less than 4 inches. Bond and interlock each course of each wythe at corners. Do not use units with less-than-nominal 4-inch horizontal face dimensions at corners or jambs.
- D. Stopping and Resuming Work: Stop work by stepping back units in each course from those in course below; do not tooth. When resuming work, clean masonry surfaces that are to receive mortar, remove loose masonry units and mortar, and wet brick if required before laying fresh masonry.

- E. Built-in Work: As construction progresses, build in items specified in this and other Sections. Built in items shall include but not be limited to electrical boxes, door jamb anchors, structural steel, bearing plates, embed plates, recessed display cases, fire extinguisher cabinets, lockers, and other items requiring recesses within masonry construction.
1. Built-in items shall be installed plumb and level.
 2. Fill in solidly with masonry and grout around built-in items.
 3. Where built-in items are to be embedded in cores of hollow masonry units, place a layer of metal lath, wire mesh or plastic mesh in the joint below and rod mortar or grout into core.
 4. Bed anchors of metal door and glazed frames in mortar joints.
 - a. Fill pressed steel frame voids solid with mortar.
 - b. Fill masonry cores with grout and reinforcing as indicated on the Structural Drawings.
 5. Grout cores in hollow concrete masonry units under bearing plates, beams, lintels, posts and similar items as indicated on the structural drawings.
 6. Grout cores in hollow concrete masonry units at post-installed anchor locations as indicated on the structural drawings.
 7. In masonry construction the General Trades / Masonry Contractor shall ensure that all built-in items including electrical boxes remain plumb and flush to the face of all masonry walls. The General Trades / Masonry Contractor shall be responsible to fix all overcuts.
 8. At exposed beam pocket locations mason shall provide scribed concrete masonry unit face shells
 - a. Provide 1/2 inch joint between scribed masonry and structural element
- F. Fill space between interior steel frames and masonry solidly with mortar unless otherwise indicated.
- G. Fill space between exterior steel frames and masonry with thermal breaking material.
- H. Fill cores in hollow CMUs with grout 24 inches under bearing plates, beams, lintels, posts, and similar items unless otherwise indicated.
- I. Build nonload-bearing interior partitions full height of story to underside of solid floor or roof structure above unless otherwise indicated.
1. Install compressible filler in joint between top of partition and underside of structure above.
 2. Fasten partition top anchors to structure above and build into top of partition. Use clip angles or steel rods as indicated on structural documents.
 - a. Unless noted otherwise, grout cells of CMUs solidly around plastic tubes of anchors and push tubes down into grout to provide 3/4-inch clearance between end of anchor rod and end of tube. Space anchors as noted on the Drawings or 24" o.c. max.
 3. At fire-rated partitions, treat joint between top of partition and underside of structure above to comply with Section 07 84 43 "Joint Firestopping."

3.6 MORTAR BEDDING AND JOINTING

- A. Bed joints at foundations – In the starting course on foundations and other supporting members, construct bed joints so that the bed joint thickness is at least 1/4 in. and not more than:
1. 3/4 in. when the masonry is ungrouted or partially grouted.
 2. 1-1/4 in. when the first course of masonry is solid grouted and supported by a concrete foundation.
- B. Bed and head joints - Unless otherwise required, construct 3/8-in. thick bed and head joints, except at foundation. Construct bed joint of the starting course of foundation with a thickness not less than 1/4 in. and not more than 3/4 in. Construct joints that also conform to the following:
1. Fill holes not specified in exposed and below grade masonry with mortar.
 2. Unless otherwise required, tool joint with a round jointer when the mortar is thumbprint hard.
 3. Remove masonry protrusions extending 1/2 in. or more into cells or cavities to be grouted.
- C. Collar joints - Unless otherwise required, solidly fill collar joints less than 3/4 in. wide with mortar as the job progresses.
- D. Hollow units - Place hollow units so:
1. Face shells of bed joints are fully mortared.
 2. Webs are fully mortared in all courses of piers, columns and pilasters, in the starting course on foundations, and when necessary to confine grout or loose-fill insulation.
 3. Head joints are mortared, a minimum distance from each face equal to the face shell thickness of the unit.
 4. Vertical cells to be grouted are aligned and unobstructed openings for grout are provided in accordance with the Project Drawings.
- E. Solid units — Unless otherwise required, solidly fill bed and head joints with mortar and:
1. Do not fill head joints by slushing with mortar.
 2. Construct head joints by shoving mortar tight against the adjoining unit.
 3. Do not deeply furrow bed joints.
- F. All units
1. Place clean units while the mortar is soft and plastic. Remove and re-lay in fresh mortar any unit disturbed to the extent that initial bond is broken after initial positioning.
 2. Cut exposed edges or faces of masonry units smooth, or position so that exposed faces or edges are unaltered manufactured surfaces.
 3. When the bearing of a masonry wythe on its support is less than two-thirds of the wythe thickness, notify the Architect/Engineer.

- G. Tool exposed joints slightly concave when thumbprint hard, using a jointer larger than joint thickness unless otherwise indicated.
- H. Cut joints flush for masonry walls to receive plaster or other direct-applied finishes (other than paint) unless otherwise indicated.
- I. Cut joints flush where indicated to receive waterproofing unless otherwise indicated.

3.7 MASONRY-JOINT REINFORCEMENT

- A. General: Install entire length of longitudinal side rods in mortar with a minimum cover of 5/8 inch on exterior side of walls or if exposed to earth, 1/2 inch elsewhere. Lap reinforcement a minimum of 6 inches.
 - 1. Ensure that all ends of longitudinal wires of joint reinforcement at laps are embedded in mortar or grout.
 - 2. Space reinforcement not more than 16 inches o.c.
 - 3. Space reinforcement not more than 8 inches o.c. in foundation walls and parapet walls.
 - 4. Provide reinforcement not more than 8 inches above and below wall openings and extending 12 inches beyond openings in addition to continuous reinforcement.
- B. Interrupt joint reinforcement at control and expansion joints unless otherwise indicated.
- C. Provide continuity at wall intersections by using prefabricated T-shaped units.
- D. Provide continuity at corners by using prefabricated L-shaped units.

3.8 ANCHOR BOLTS

- A. For anchor bolts placed in the top of grouted cells and bond beams, maintain a clear distance between the bolt and the face of masonry unit of at least 1/4 in. when using fine grout and at least 1/2 in. when using coarse grout.
- B. For anchor bolts placed through the face shell of a hollow masonry unit, drill a hole that is tight fitting to the bolt or provide minimum clear distance that conforms to clear distances noted above around the bolt and through the face shell. For the portion of the bolt that is within the grouted cell, maintain a clear distance between the bolt and the face of masonry unit and between the head or bent leg of the bolt and the formed surface of grout of at least 1/4 in. when using fine grout and at least 1/2 inch when using coarse grout.
- C. Place anchor bolts with a clear distance between parallel anchor bolts not less than the nominal diameter of the anchor bolt, nor less than 1 inch.

3.9 CONTROL AND EXPANSION JOINTS

- A. General: Install control- and expansion-joint materials in unit masonry as masonry progresses. Do not allow materials to span control and expansion joints without provision to allow for in-plane wall or partition movement.
- B. Form control joints in concrete masonry using one of the following methods:

1. Fit bond-breaker strips into hollow contour in ends of CMUs on one side of control joint. Fill resultant core with grout, and rake out joints in exposed faces for application of sealant.
2. Install preformed control-joint gaskets designed to fit standard sash block.
3. Install interlocking units designed for control joints. Install bond-breaker strips at joint. Keep head joints free and clear of mortar, or rake out joint for application of sealant.

3.10 LINTELS

- A. Provide concrete and masonry lintels where shown and where openings of more than 12 inches for brick-size units and 24 inches for block-size units are shown without structural steel or other supporting lintels.
- B. Provide minimum bearing of 8 inches at each jamb unless otherwise indicated.

3.11 BOND BEAMS

- A. Continuous bond beams shall be located at the following locations:
 1. Top of walls
 2. Under roof framing bearing locations
 3. Additional bond beams to be placed at 10'-0" oc minimum.
- B. Bond beam reinforcing shall be continuous through control joints at bearing walls, unless noted otherwise on drawings.
- C. Continuous bond beams shall be located at the top of non-load bearing partition walls
 1. Where joists pass through the concrete masonry wall, bond beam shall be lowered so the bond beam is not cut by the joist pass-thru.

3.12 REINFORCED UNIT MASONRY INSTALLATION

- A. Temporary Formwork and Shores: Construct formwork and shores as needed to support reinforced masonry elements during construction.
 1. Construct formwork to provide shape, line, and dimensions of completed masonry as indicated. Make forms sufficiently tight to prevent leakage of mortar and grout. Brace, tie, and support forms to maintain position and shape during construction and curing of reinforced masonry.
 2. Do not remove forms and shores until reinforced masonry members have hardened sufficiently to carry their own weight and other loads that may be placed on them during construction.
- B. Placing Reinforcement:
 1. Support reinforcement using rebar positioners to prevent displacement by construction loads or by placement of grout or mortar, beyond the allowable tolerances.
 2. Completely embed reinforcing bars in grout in accordance with Grout Placement Article below.
 3. Maintain clear distance between reinforcing bars and the interior face of masonry unit or formed surface of at least 1/4 in. for fine grout and 1/2 in. for coarse grout, except where cross webs of hollow units are used as supports for horizontal reinforcement.
 4. Place reinforcing bars maintaining the following minimum cover:

- a. Masonry face exposed to earth or weather: 2 in. for bars larger than No.5; 1-1/2 in. for No.5 bars or smaller.
 - b. Masonry not exposed to earth or weather: 1-1/2 in.
5. Maintain minimum clear distance between parallel bars of the nominal bar size or 1 in. , whichever is greater.
 6. In columns and pilasters, maintain minimum clear distance between vertical bars of one and on-half times the nominal bar size or 1-1/2 in., whichever is greater.
 7. Splice only where indicated on the Project Drawings, unless otherwise acceptable. When splicing by welding, provide welds in conformance with the provisions of AWS D 1.4.
 8. Unless accepted by the Architect/Engineer, do not bend reinforcement after it is embedded in grout or mortar.
 9. Noncontact lap splices - Position bars spliced by noncontact lap splice no farther apart transversely than one-fifth the specified length of lap nor more than 8 in.
 10. Placement tolerances
 - a. Tolerances for the placement of reinforcing bars in walls and flexural elements shall be +/- 1/2 when the distance from the centerline of reinforcing bars to the opposite face of masonry, d, is equal to 8 in. or less, +/- 1 in. for d equal to 24 in. or less but greater than 8 in. , and +/- 1-1/4 in. for d greater than 24 in.
 - b. Place vertical bars within:
 - 1) 2 in. of the required location along the length of the wall when the wall segment length exceeds 24 in.
 - 2) 1 in. of the required location along the length when the wall segment does not exceed 24 in.
 - c. If it is necessary to move bars more than one bar diameter or a distance exceeding the tolerance stated above to avoid interference with other reinforcing steel, conduits, or embedded items, notify the Architect/Engineer for acceptance of the resulting arrangement of bars.
 - d. Foundation dowels that interfere with unit webs are permitted to be bent to a maximum of 1 in. horizontally for every 6 in. of vertical height.
- 3.13 Grouting:
- A. Do not place grout until entire height of masonry to be grouted has attained enough strength to resist grout pressure.
 - B. Placing time - Place grout within 1 1/2 hr from introducing water in the mixture and prior to initial set.
 1. Discard site-mixed grout that does not meet the specified slump without adding water after initial mixing.

2. For ready-mixed grout:
 - a. Addition of water is permitted at the time of discharge to adjust slump.
 - b. Discard ready-mixed grout that does not meet the specified slump without adding water, other than the water that was added at the time of discharge.
 - c. The time limitation is waived as long as the ready-mixed grout meets the specified slump.

C. Confinement - Confine grout to the areas indicated on the Project Drawings. Use material to confine grout that permits bond between masonry units and mortar.

D. Grout pour height - Do not exceed the maximum grout pour height given in Table 2 below.

Table 2 - Grout space requirements

Grout Type ¹	Maximum grout pour height (ft)	Minimum width of grout space ^{2,3} (in.)	Minimum grout space dimensions for grouting cells of hollow units ^{3,4} (in. x in.)
Fine	1	3/4	1 1/2 x 2
Fine	5.33	2	2 x 3
Fine	12.67	2 1/2	2 1/2 x 3
Fine	24	3	3 x 3
Coarse	1	1 1/2	1 1/2 x 3
Coarse	5.33	2	2 1/2 x 3
Coarse	12.67	2 1/2	3 x 3
Coarse	24	3	3 x 4

¹ Fine and coarse grouts are defined in ASTM C476.

² For grouting between masonry wythes.

³ Minimum clear width of grout space and minimum clear grout space dimension are the net dimension of the space determined by subtracting masonry protrusions and the diameters of horizontal bars from the as-built cross-section of the grout space. Select the grout type and maximum grout pour height based on the minimum clear space.

⁴ Area of vertical reinforcement shall not exceed 6 percent of the area of the grout space.

E. Grout lift height

1. For grout conforming to ASTM C476
 - a. Where the following conditions are met, place grout in lifts not exceeding 12ft 8in
 - 1) The masonry has cured for at least 4 hours.
 - 2) The grout slump is maintained between 10 and 11 in.
 - 3) No intermediate reinforced bond beams are placed between the top and the bottom of the pour height.
 - b. When the conditions of Items '1' and '2' above are met but there are intermediate bond beams within the grout pour, limit the grout lift height to the bottom of the lowest bond beam that is more than 5.33 ft above the bottom of the lift, but do not exceed a grout lift height of 12ft 8 in.
 - c. When the conditions of Items '1' or '2' above are not met, place grout in lifts not exceeding 5.33 ft.

2. For self-consolidating grout conforming to ASTM C476:
 - a. When placed in masonry that has cured for at least 4 hours, place in lifts not exceeding the grout pour height.
 - b. When placed in masonry that has not cured for at least 4 hours, place in lifts not exceeding 5.33 ft

F. Consolidation

1. Consolidate grout at the time of placement.
 - a. Consolidate grout pours 12 in. or less in height by mechanical vibration or by puddling.
 - b. Consolidate pours exceeding 12 inches in height by mechanical vibration, and reconsolidate by mechanical vibration after initial water loss and settlement has occurred.
2. Consolidation or reconsolidation is not required for self-consolidating grout.

G. Grout key - When grouting, form grout keys between grout pours. Form grout keys between grout lifts when the first lift is permitted to set prior to placement of the subsequent lift

1. Form a grout key by terminating the grout a minimum of 1/2 in. below a mortar joint.
2. Do not form grout keys within beams.
3. At beams or lintels laid with closed bottom units, terminate the grout pour at the bottom of the beam or lintel without forming a grout key.

H. Alternate grout placement - Place masonry units and grout using construction procedures employed in the accepted grout demonstration panel.

3.14 FIELD QUALITY CONTROL

- A. Testing and Inspecting: Owner will engage special inspectors to perform tests and inspections and prepare reports. Allow inspectors access to scaffolding and work areas as needed to perform tests and inspections. Retesting of materials that fail to comply with specified requirements shall be done at Contractor's expense.
- B. Inspections: Special inspections according to Level 2 in Chapter 17 of the Ohio Building Code.
 1. Begin masonry construction only after inspectors have verified proportions of site-prepared mortar.
 2. Place grout only after inspectors have verified compliance of grout spaces and of grades, sizes, and locations of reinforcement.
 3. Place grout only after inspectors have verified proportions of site-prepared grout.
- C. Testing Frequency: One set of tests for each 5000 sq. ft. of wall area or portion thereof.
- D. Verify f'm in accordance with the Quality assurance requirements specified in Part 1 of this specification.

- E. Concrete Masonry Unit Test: For each type of unit provided, according to ASTM C 140 for compressive strength.
- F. Mortar Aggregate Ratio Test (Proportion Specification): For each mix provided, according to ASTM C 780.
 - 1. Inspector to periodically observe actual mortar mixing procedures
- G. Grout Test (Compressive Strength): For each mix provided, according to ASTM C 1019.

3.15 PARGING

- A. Parge exterior faces of below-grade masonry walls, where indicated, in two uniform coats to a total thickness of 3/4 inch. Dampen wall before applying first coat, and scarify first coat to ensure full bond to subsequent coat.
- B. Use a steel-trowel finish to produce a smooth, flat, dense surface with a maximum surface variation of 1/8 inch per foot. Form a wash at top of parging and a cove at bottom.
- C. Damp-cure parging for at least 24 hours and protect parging until cured.

3.16 REPAIRING, POINTING, AND CLEANING

- A. Remove and replace masonry units that are loose, chipped, broken, stained, or otherwise damaged or that do not match adjoining units. Install new units to match adjoining units; install in fresh mortar, pointed to eliminate evidence of replacement.
- B. Pointing: During the tooling of joints, enlarge voids and holes, except weep holes, and completely fill with mortar. Point up joints, including corners, openings, and adjacent construction, to provide a neat, uniform appearance. Prepare joints for sealant application, where indicated.
- C. In-Progress Cleaning: Clean unit masonry as work progresses by dry brushing to remove mortar fins and smears before tooling joints.
- D. Final Cleaning: After mortar is thoroughly set and cured, clean exposed masonry as follows:
 - 1. Remove large mortar particles by hand with wooden paddles and nonmetallic scrape hoes or chisels.
 - 2. Test cleaning methods on sample wall panel; leave one-half of panel uncleaned for comparison purposes. Obtain Architect's approval of sample cleaning before proceeding with cleaning of masonry.
 - 3. Clean concrete masonry by applicable cleaning methods indicated in NCMA TEK 8-4A.

3.17 MASONRY WASTE DISPOSAL

- A. Salvageable Materials: Unless otherwise indicated, excess masonry materials are Contractor's property. At completion of unit masonry work, remove from Project site.
- B. Waste Disposal as Fill Material: Dispose of clean masonry waste, including excess or soil-contaminated sand, waste mortar, and broken masonry units, by crushing and mixing with fill material as fill is placed.

1. Crush masonry waste to less than 4 inches in each dimension.
 2. Mix masonry waste with at least two parts of specified fill material for each part of masonry waste. Fill material is specified in Section 31 20 00 "Earth Moving."
 3. Do not dispose of masonry waste as fill within 18 inches of finished grade.
- C. Masonry Waste Recycling: Return broken CMUs not used as fill to manufacturer for recycling.
- D. Excess Masonry Waste: Remove excess clean masonry waste that cannot be used as fill, as described above or recycled, and other masonry waste, and legally dispose of off Owner's property.

END OF SECTION 042200

SECTION 044313.16 - ADHERED STONE MASONRY VENEER

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:
 - 1. Stone masonry adhered to unit masonry backup.

1.3 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site

1.4 ACTION SUBMITTALS

- A. Product Data: For each variety of stone, stone accessory, and manufactured product.
- B. Samples for Initial Selection: For colored mortar and other items involving color selection.
- C. Samples for Verification:
 - 1. For each stone type indicated. Include at least three Samples in each set, and show the full range of color and other visual characteristics in completed Work.
 - 2. For each color of mortar required. Label Samples to indicate types and amounts of pigments used.

1.5 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For Installer.
- B. List of Materials Used in Constructing Mockups: List generic product names together with manufacturers, manufacturers' product names, supply sources, and other information as required to identify materials used. Include mix proportions for mortar and source of aggregates.
 - 1. Neither receipt of list nor approval of mockups constitutes approval of deviations from the Contract Documents contained in mockups unless Architect approves such deviations in writing.

C. Material Test Reports:

1. Stone Test Reports: For stone variety proposed for use on Project, by a qualified testing agency, indicating compliance with required physical properties, other than abrasion resistance, according to referenced ASTM standards. Base reports on testing done within **five** years.
2. Sealant Compatibility and Adhesion Test Report: From sealant manufacturer, indicating that sealants will not stain or damage stone. Include interpretation of test results and recommendations for primers and substrate preparation needed for adhesion.

1.6 QUALITY ASSURANCE

- A. Installer Qualifications: A qualified installer who employs experienced stonemasons and stone fitters.
- B. Mockups: Build mockups to demonstrate aesthetic effects and to set quality standards for materials and execution.
 1. Build mockup of typical wall area as shown on Drawings.
 2. Build mockups for typical exterior wall in sizes approximately 48 inches long by 48 inches high by full thickness, including face and backup construction and accessories.
 - a. Include stone coping at top of mockup.
 3. Protect accepted mockups from the elements with weather-resistant membrane.
 4. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
 5. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Store cementitious materials on elevated platforms, under cover, and in a dry location. Do not use cementitious materials that have become damp.
- B. Store aggregates where grading and other required characteristics can be maintained and contamination avoided.
- C. Deliver preblended, dry mortar mix in moisture-resistant containers designed for use with dispensing silos. Store preblended, dry mortar mix in delivery containers on elevated platforms, under cover, in a dry location, or in covered weatherproof dispensing silos.

1.8 FIELD CONDITIONS

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

- B. Stain Prevention: Immediately remove mortar and soil to prevent them from staining stone masonry face.
 - 1. Protect base of walls from rain-splashed mud and mortar splatter, using coverings spread on the ground and over the wall surface.
 - 2. Protect sills, ledges, and projections from mortar droppings.
 - 3. Turn scaffold boards near the wall on edge at end of each day to prevent rain from splashing mortar and dirt on completed stone masonry.

- C. Cold-Weather Requirements: Do not use frozen materials or materials mixed or coated with ice or frost. Do not build on frozen substrates. Remove and replace stone masonry damaged by frost or freezing conditions. Comply with cold-weather construction requirements contained in TMS 602/ACI 530.1/ASCE 6.
 - 1. Cold-Weather Cleaning: Use liquid cleaning methods only when air temperature is 40 deg F and above and will remain so until masonry has dried, but not less than seven days after completing cleaning.

- D. Hot-Weather Requirements: Comply with hot-weather construction requirements contained in TMS 602/ACI 530.1/ASCE 6.

1.9 COORDINATION

- A. Advise installers of other work about specific requirements for placement of flashing and similar items to be built into stone masonry.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Source Limitations for Stone: Obtain stone from a single quarry with resources to provide materials of consistent quality in appearance and physical properties.

- B. Source Limitations for Mortar Materials: Obtain mortar ingredients of uniform quality for each cementitious component from single manufacturer and each aggregate from single source or producer.

2.2 OTHER STONE (Match Existing)

- A. Material Standards:
 - 1. Maximum Absorption according to ASTM C97/C97M: 7.5 percent.
 - 2. Minimum Compressive Strength according to ASTM C170/C170M: 4000 psi

- B. Varieties and Sources: Subject to compliance with requirements, provide the following:
 - 1. Veneer stone of similar character as the existing stone forming the wall near the original building entrance.

- C. Match Architect's samples for color, finish, and other stone characteristics relating to aesthetic effects.

2.3 MORTAR MATERIALS

- A. Portland Cement: ASTM C150/C150M, Type I or Type II, except Type III may be used for cold-weather construction; natural color or white cement may be used as required to produce mortar color indicated.
1. Low-Alkali Cement: Not more than 0.60 percent total alkali when tested according to ASTM C114.
- B. Hydrated Lime: ASTM C207, Type S.
- C. Portland Cement-Lime Mix: Packaged blend of portland cement and hydrated lime containing no other ingredients.
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Essroc.
 - b. Holcim (US) Inc.
 - c. Lafarge North America Inc.
 - d. Lehigh Hanson; HeidelbergCement Group.
- D. Mortar Cement: ASTM C1329/C1329M.
1. Manufacturers: Subject to compliance with requirements, provide products by the following:
 - a. Lafarge North America Inc.
- E. Masonry Cement: ASTM C91/C91M.
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Cemex S.A.B. de C.V.
 - b. Essroc.
 - c. Holcim (US) Inc.
 - d. Lafarge North America Inc.
 - e. Lehigh Hanson; HeidelbergCement Group.
- F. Mortar Pigments: Natural and synthetic iron oxides and chromium oxides, compounded for use in mortar mixes and complying with ASTM C979/C979M. Use only pigments with a record of satisfactory performance in stone masonry mortar.
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Davis Colors.
 - b. Euclid Chemical Company (The); an RPM company.
 - c. Solomon Colors, Inc.
- G. Colored Portland Cement-Lime Mix: Packaged blend of portland cement, hydrated lime, and mortar pigments. Mix shall produce color indicated or, if not indicated, as selected from manufacturer's standard colors. Pigments shall not exceed 10 percent of portland cement by weight.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Holcim (US) Inc.
 - b. Lafarge North America Inc.
 - c. Laticrete International, Inc.
 - d. Lehigh Hanson; HeidelbergCement Group.

- H. Colored Masonry Cement Mix: Packaged blend of masonry cement and mortar pigments. Mix shall produce color indicated or, if not indicated, as selected from manufacturer's standard colors. Pigments shall not exceed 5 percent of masonry cement by weight.
 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Cemex S.A.B. de C.V.
 - b. Essroc.
 - c. Holcim (US) Inc.
 - d. Lafarge North America Inc.
 - e. Laticrete International, Inc.
 - f. Lehigh Hanson; HeidelbergCement Group.

- I. Aggregate: ASTM C144 and as follows:
 1. For pointing mortar, use aggregate graded with 100 percent passing No. 16 sieve.
 2. White Aggregates: Natural white sand or ground white stone.
 3. Colored Aggregates: Natural-colored sand or ground marble, granite, or other sound stone; of color necessary to produce required mortar color.
 - a. Match Architect's sample.

- J. Latex Additive: Manufacturer's standard water emulsion, serving as replacement for part or all of gaging water, of type specifically recommended by latex-additive manufacturer for use with field-mixed portland cement mortar bed, and not containing a retarder.
 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Boiardi Products Corporation; a QEP company.
 - b. Bostik, Inc.
 - c. C-Cure.
 - d. Custom Building Products.
 - e. H.B. Fuller Construction Products Inc. / TEC.
 - f. Laticrete International, Inc.
 - g. MAPEI Corporation.
 - h. Parex USA, Inc.
 - i. Southern Grouts & Mortars, Inc.

- K. Cold-Weather Admixture: Nonchloride, noncorrosive, accelerating admixture complying with ASTM C494/C494M, Type C, and recommended by manufacturer for use in masonry mortar of composition indicated.

- L. Water: Potable.

2.4 MISCELLANEOUS MASONRY ACCESSORIES

- A. Compressible Filler: Premolded filler strips complying with ASTM D1056, Grade 2A1; compressible up to 35 percent; of width and thickness indicated; formulated from neoprene.
- B. Expanded Metal Lath: 3.4 lb/sq. yd., self-furring, diamond-mesh lath complying with ASTM C847. Fabricate from structural-quality, zinc-coated (galvanized) steel sheet complying with ASTM A653/A653M, G60.
- C. Lath Attachment Devices: Material and type required by ASTM C1063 for installations indicated.

2.5 MASONRY CLEANERS

- A. Proprietary Acidic Cleaner: Manufacturer's standard-strength cleaner designed for removing mortar and grout stains, efflorescence, and other new construction stains from stone masonry surfaces without discoloring or damaging masonry surfaces; expressly approved for intended use by cleaner manufacturer and stone producer.

2.6 FABRICATION

- A. General: Fabricate stone units in sizes and shapes required to comply with requirements indicated.
- B. Select stone to produce pieces of thickness, size, and shape as required to mimic existing stone used on site.
- C. Carefully inspect stone at quarry or fabrication plant for compliance with requirements for appearance, material, and fabrication. Replace defective units before shipment.
 - 1. Clean sawed backs of stone to remove rust stains and iron particles.
- D. Gage backs of stones for adhered veneer if more than 81 sq. in. in area.
- E. Thickness of Stone: Provide thickness indicated, but not less than the following:
 - 1. Thickness: 1 inch plus or minus 1/8 inch.
- F. Finish exposed stone faces and edges to comply with requirements indicated for finish and to match approved samples and mockup.
 - 1. Finish: Match existing wall.

2.7 MORTAR MIXES

- A. General: Do not use admixtures, including pigments, air-entraining agents, accelerators, retarders, water-repellent agents, antifreeze compounds, or other admixtures, unless otherwise indicated.
 - 1. Do not use calcium chloride.
 - 2. Use portland cement-lime, masonry cement, or mortar cement mortar unless otherwise indicated.
 - 3. Add cold-weather admixture (if used) at same rate for all mortar that will be exposed to view, regardless of weather conditions, to ensure that mortar color is consistent.

4. Mixing Pointing Mortar: Thoroughly mix cementitious and aggregate materials together before adding water. Then mix again, adding only enough water to produce a damp, unworkable mix that will retain its form when pressed into a ball. Maintain mortar in this dampened condition for one to two hours. Add remaining water in small portions until mortar reaches required consistency. Use mortar within 30 minutes of final mixing; do not retemper or use partially hardened material.
- B. Preblended, Dry Mortar Mix: Furnish dry mortar ingredients in the form of a preblended mix. Measure quantities by weight to ensure accurate proportions, and thoroughly blend ingredients before delivering to Project site.
- C. Mortar for Stone Masonry: Comply with ASTM C270, Proportion Specification.
 1. Mortar for Setting Stone: Type S
 2. Mortar for Pointing Stone: Type N
- D. Latex-Modified Portland Cement Setting Mortar: Proportion and mix portland cement, aggregate, and latex additive to comply with latex-additive manufacturer's written instructions.
- E. Cement-Paste Bond Coat: Mix either neat cement and water or cement, sand, and water to a consistency similar to that of thick cream.
 1. For latex-modified portland cement, setting-bed mortar, substitute latex admixture for part or all of water, according to latex-additive manufacturer's written instructions.
- F. Mortar for Scratch Coat over Metal Lath: 1 part portland cement, 1/2 part lime, 5 parts loose damp sand, and enough water to produce a workable consistency.
- G. Mortar for Scratch Coat over Unit Masonry: 1 part portland cement, 1 part lime, 7 parts loose damp sand, and enough water to produce a workable consistency.
- H. Pigmented Mortar: Use colored cement product or select and proportion pigments with other ingredients to produce color required. Do not add pigments to colored cement products.
 1. Pigments shall not exceed 10 percent of portland cement by weight.
 2. Pigments shall not exceed 5 percent of masonry cement or mortar cement by weight.
 3. Mix to match Architect's sample.
- I. Colored-Aggregate Mortar: Produce required mortar color by using colored aggregates and natural color or white cement as necessary.
 1. Mix to match Architect's sample.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine surfaces indicated to receive stone masonry, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of stone masonry.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Clean dirty or stained stone surfaces by removing soil, stains, and foreign materials before setting. Clean stone by thoroughly scrubbing with fiber brushes and then drenching with clear water. Use only mild cleaning compounds that contain no caustic or harsh materials or abrasives.

3.3 SETTING STONE MASONRY

- A. Perform necessary field cutting and trimming as stone is set.
 - 1. Use hammer and chisel to split stone that is fabricated with split surfaces. Make edges straight and true, matching similar surfaces that were shop or quarry fabricated.
 - 2. Pitch face at field-split edges as needed to match stones that are not field split.
- B. Sort stone before it is placed in wall to remove stone that does not comply with requirements relating to aesthetic effects, physical properties, or fabrication, or that is otherwise unsuitable for intended use.
- C. Arrange stones in pattern to achieve aesthetic consistent with existing wall.
- D. Set stone to comply with requirements indicated on Drawings. Install supports, fasteners, and other attachments indicated or necessary to secure stone masonry in place. Set stone accurately in locations indicated, with edges and faces aligned according to established relationships and indicated tolerances.

3.4 CONSTRUCTION TOLERANCES

- A. Variation from Plumb: For vertical lines and surfaces, do not exceed 1/4 inch in 10 feet, 3/8 inch in 20 feet, or 1/2 inch in 40 feet or more. For external corners, expansion joints, control joints, and other conspicuous lines, do not exceed 1/4 inch in 20 feet or 1/2 inch in 40 feet or more.
- B. Variation from Level: For lines of cap and other conspicuous lines, do not exceed 1/4 inch in 20 feet or 1/2 inch in 40 feet or more.
- C. Measure variation from level, plumb, and position shown in plan as a variation of the average plane of each stone face from level, plumb, or dimensioned plane.
- D. Variation in Plane between Adjacent Stones: Do not exceed one-half of tolerance specified for thickness of stone.

3.5 INSTALLATION OF ADHERED STONE MASONRY VENEER

- A. Install lath over unit masonry and concrete to comply with ASTM C1063.
- B. Install scratch coat over metal lath 3/8 inch thick to comply with ASTM C926.
- C. Coat backs of stone units and face of scratch coat with cement-paste bond coat, then butter both surfaces with setting mortar. Use sufficient setting mortar, so a slight excess will be forced out the edges of stone units as they are set. Tap units into place, completely filling space between units and scratch coat.
- D. Rake out joints for pointing with mortar to depth of not less than **1/2 inch** before setting mortar has hardened. Rake joints to uniform depths with square bottoms and clean sides.

3.6 POINTING

- A. Prepare stone-joint surfaces for pointing with mortar by removing dust and mortar particles. Where setting mortar was removed to depths greater than surrounding areas, apply pointing mortar in layers not more than 3/8 inch deep until a uniform depth is formed.
- B. Point stone joints by placing and compacting pointing mortar in layers of not more than 3/8 inch deep. Compact each layer thoroughly, and allow to it become thumbprint hard before applying next layer.

3.7 ADJUSTING AND CLEANING

- A. Remove and replace stone masonry of the following description:
 - 1. Broken, chipped, stained, or otherwise damaged stone. Stone may be repaired if methods and results are approved by Architect.
 - 2. Stone masonry not matching approved samples and mockups.
 - 3. Stone masonry not complying with other requirements indicated.
- B. Replace in a manner that results in stone masonry matching approved samples and mockups, complying with other requirements, and showing no evidence of replacement.
- C. In-Progress Cleaning: Clean stone masonry as work progresses. Remove mortar fins and smears before tooling joints.
- D. Final Cleaning: After mortar is thoroughly set and cured, clean stone masonry as follows:
 - 1. Remove large mortar particles by hand with wooden paddles and nonmetallic scrape hoes or chisels.
 - 2. Test cleaning methods on mockup; leave one-half of panel uncleaned for comparison purposes. Obtain Architect's approval of sample cleaning before cleaning stone masonry.
 - 3. Protect adjacent stone and nonmasonry surfaces from contact with cleaner by covering them with liquid strippable masking agent, polyethylene film, or waterproof masking tape.
 - 4. Wet wall surfaces with water before applying cleaner; remove cleaner promptly by rinsing thoroughly with clear water.
 - 5. Clean stone masonry by bucket and brush hand-cleaning method described in BIA Technical Note No. 20, Revised II, using job-mixed detergent solution.

3.8 EXCESS MATERIALS AND WASTE

- A. Excess Stone: Stack excess stone where directed by Owner for Owner's use.
- B. Disposal as Fill Material: Dispose of clean masonry waste, including mortar and excess or soil-contaminated sand, by crushing and mixing with fill material as fill is placed.
 - 1. Crush masonry waste to less than 4 inches in greatest dimension.
 - 2. Mix masonry waste with at least 2 parts of specified fill material for each part of masonry waste.
 - 3. Do not dispose of masonry waste as fill within 18 inches of finished grade.
- C. Excess Masonry Waste: Remove excess clean masonry waste that cannot be used as fill, as described above, and other waste, and legally dispose of off Owner's property.

END OF SECTION 044313.16

5

DIVISION

METALS

SECTION 050523 – POST-INSTALLED ANCHORS

PART 1 - GENERAL

When the information in this Specification Section conflicts with information on the Structural Construction Drawings, the Structural Construction Drawings shall prevail.

1.1 SUMMARY

- A. Section Includes:
 - 1. Requirements pertaining to post-installed anchors for materials and equipment. This section pertains to all other sections of these specifications that require post-installed anchors unless specified otherwise.

1.2 DEFINITIONS

- A. Adhesive: Chemical components formulated from organic polymers, or a combination of organic polymers and inorganic materials that cure when blended together
- B. Adhesive anchor: A post-installed anchor, inserted into hardened concrete with an anchor hole diameter not greater than 1.5 times the anchor diameter, that transfers loads to the concrete by bond between the anchor and the adhesive, and bond between the adhesive and the concrete.
- C. Edge Distance: The distance from the edge of the concrete surface to the center of the nearest anchor
- D. Effective embedment depth: The overall depth through which the anchor transfers force to or from the surrounding concrete. The effective embedment depth will normally be the depth of the concrete failure surface in tension applications.
- E. Expansion Anchor: A post-installed anchor, inserted into hardened concrete that transfers loads to or from the concrete by direct bearing or friction or both. Expansion anchors may be torque-controlled, where the expansion is achieved by a torque acting on the screw or bolt; or displacement-controlled, where the expansion is achieved by impact forces acting on a sleeve or plug and the expansion is controlled by the length of travel of the sleeve or plug.
- F. Manufacturer's Printed Installation Instructions (MPII): Published instructions for the correct installation of the anchor under all covered installation conditions as supplied in the product packaging.
- G. Post-installed anchor: An anchor installed in hardened concrete. Expansion, undercut, and adhesive anchors are examples of post-installed anchors.
- H. Primary Structural System: The completed combination of elements which serve to support the building's self weight, the applicable live load which is based upon the occupancy and use of the spaces, and the environmental loads such as wind, seismic, and thermal. Curtain wall members, non-load bearing walls and exterior facade are examples of items which are not part of the Primary Structural System.
- I. Undercut anchor: A post-installed anchor that develops its tensile strength from the mechanical interlock provided by undercutting of the concrete at the embedded end of the anchor. The undercutting is achieved with a special drill before installing the anchor or alternatively by the anchor itself during its installation.

1.2 REFERENCES

- A. ACI 318 – Building Code Requirements for Structural Concrete
- B. ACI 355.2 – Qualification of Post-Installed Mechanical Anchors in Concrete
- C. ACI 355.4 – Qualification of Post-Installed Adhesive Anchors in Concrete
- D. ASTM E488 – Standard Test Methods for Strength of Anchors in Concrete and Masonry Elements
- E. ICC-ES AC01 – Acceptance Criteria for Expansion Anchors in Masonry Elements
- F. ICC-ES AC58 – Acceptance Criteria for Adhesive Anchors in Masonry Elements
- G. ICC-ES AC60 – Acceptance Criteria for Anchors in Unreinforced Masonry Elements
- H. ICC-ES AC70 – Acceptance Criteria for Fasteners Power-Driven into Concrete, Steel and Masonry Elements
- I. ICC-ES AC106 – Acceptance Criteria for Predrilled Fasteners (Screw Anchors) in Masonry Elements
- J. ICC-ES AC193 – Acceptance Criteria for Mechanical Anchors in Concrete Elements
- K. ICC-ES AC308 – Acceptance Criteria for Post-Installed Adhesive Anchors in Concrete Elements

1.3 DELEGATED DESIGN

- A. Engage a qualified professional engineer registered in the State of Ohio, as defined in Section 014000 "Quality Requirements," to design anchors that are not part of the Primary Structural System or are not already fully detailed on the Construction Drawings.
- B. For each non-structural application, provide data substantiating specified design requirements, signed and sealed by the qualified professional engineer.
- C. Select anchor type appropriate to conditions and item being fastened.
- D. If required loading capacity is not indicated on the drawings, determine required loading capacity in accordance with accepted engineering principles and as required by applicable code.
- E. Confirm application requirements for cracked and uncracked concrete substrates.

1.4 ACTION SUBMITTALS

- A. Submittals are to be in accordance with Conditions of the Contract and Division 1 Submittal Procedures Section.
- B. Product specifications with recommended design values and physical characteristics for adhesive, expansion and undercut anchors. DO NOT SUBMIT MANUFACTURER'S ENTIRE PRODUCT CATALOG
- C. Submittal shall highlight diameters and lengths proposed for the Project.
- D. Quality Assurance Submittals:

1. ICC ES Evaluation Reports.

E. Manufacturer's Printed Installation Instructions (MPII)

F. Installer Qualifications & Procedures: Submit a letter of procedure stating method of drilling, the product proposed for use, the complete installation procedure, manufacturer training date (see below) , and a list of the personnel to be trained on anchor installation.

1.5 QUALITY ASSURANCE

A. Installer Qualifications:

1. Post Installed anchors shall be installed by an installer with at least three years of experience performing similar installations.

B. Installer Training: Contractor shall arrange for an anchor manufacturer's representative to provide onsite installation training for all of their anchoring products specified. Shell + Meyer Associates, Inc. must receive documented confirmation that all of the contractor's personnel who install anchors are trained prior to the commencement of installing anchors. Training to consist of a review of the complete installation process for post installed anchors, to include but not be limited to:

1. hole drilling procedure
2. hole preparation and cleaning technique
3. adhesive injection technique and dispenser training / maintenance
4. rebar dowel preparation and installation
5. proof loading/torquing

C. Certifications: Unless otherwise authorized by the Engineer, anchors shall have the following certification:

1. ICC ES Evaluation Report indicating conformance with current applicable ICC ES Acceptance Criteria.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Store anchors in accordance with manufacturer's recommendations.

B. Anchoring adhesives must be stored at temperatures prescribed by the manufacturer and must not be used beyond the expiration date.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

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

1. Hilti Corporation www.us.hilti.com 1-800-879-8000
2. DeWalt/Powers Fasteners www.powers.com 1-800-524-3244
3. Simpson Strong-Tie www.strongtie.com 1-800-999-5099

B. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings

- C. Substitutions: Substitute in accordance with Conditions of the Contract and Division 1 Substitution Procedures Section.
1. Only manufacturers with an ICC-ES listing will be considered for substitution requests.
 2. The contractor shall submit, for Engineer-of-Record's review, calculations that are prepared and sealed by a registered Professional Engineer demonstrating that the substituted product is capable of achieving the pertinent equivalent performance values of the specified product using the appropriate design procedure and/or standard(s) as required by the Building Code.
 3. In addition, the calculations shall specify the diameter and embedment depth of the substituted product.
 4. Any increase in material costs for such submittal shall be the responsibility of the contractor.

2.2 MATERIALS

- A. Fasteners and Anchors
1. Bolts and Studs: ASTM A307; ASTM A449 where "High Strength" is indicated on the Drawings.
 2. Carbon and Alloy Steel Nuts: ASTM A563.
 3. Carbon Steel Washers: ASTM F436.
 4. Carbon Steel Threaded Rod: ASTM A36; or ASTM A193 Grade B7; or ISO 898 Class 5.8.
 5. Wedge Anchors: ASTM A510; or ASTM A108.
 6. Stainless Steel Bolts, Hex Cap Screws, and Studs: ASTM F593.
 7. Stainless Steel Nuts: ASTM F594.
 8. Zinc Plating: ASTM B633.
 9. Hot-Dip Galvanizing: ASTM A153.
 10. Reinforcing Dowels: ASTM A615.

2.3 POST INSTALLED ANCHORS IN CONCRETE SUBSTRATE

- A. All post installed anchors shall be head marked with a length code
- B. Anchors in concrete shall be designed in accordance with ACI 318 Chapter 17
- C. Expansion Anchors: Expansion type, torque-controlled, with impact section to prevent thread damage complete with required nuts and washers. Provide anchors with length identification markings conforming to ICC ES AC01 or ICC ES AC193. Type and size as indicated on Drawings.
1. Expansion anchors shall meet the criteria of ACI 355.2
 2. Interior Use: Unless otherwise indicated on the Drawings, provide carbon steel anchors with zinc plating in accordance with ASTM B633, Type III Fe/Zn 5 (SC1).
 3. Exterior Use: As indicated on the Drawings, provide stainless steel anchors. Stainless steel anchors shall be AISI Type 304 stainless steel provided with stainless steel nuts and washers of matching alloy group and minimum proof stress equal to or greater than the specified minimum full-size tensile strength of the externally threaded fastener. Stainless steel nuts shall conform to ASTM F594 unless otherwise specified. Avoid installing stainless steel anchors in contact with galvanically dissimilar metals.
 4. Where anchor manufacturer is not indicated, subject to compliance with requirements and acceptance by the Engineer, provide one of the following:
 - a. Hilti Kwik Bolt TZ, ICC ESR-1917 (carbon steel and AISI Type 304 Stainless Steel clip).
 - b. Powers Power-Stud+ SD2, ICC ESR-2502 (carbon steel and AISI Type 304 Stainless Steel clip)
 - c. Simpson Strong-Tie Strong-Bolt 2 Wedge Anchor, ICC-ES ESR-3037

- B. Screw Anchors: Screw type. Pre-drilling of the hole requires a standard ANSI drill bit with the same diameter as the anchor and installing the anchor will be done with an impact wrench. Provide anchors with a diameter and anchor length marking on the head. Type and size as indicated on Drawings.
1. Interior Use: Unless otherwise indicated on the Drawings, provide carbon steel anchors with zinc plating equivalent to DIN EN ISO 4042 (8µm min.).
 2. Where anchor manufacturer is not indicated, subject to compliance with requirements and acceptance by the Engineer, provide one of the following:
 - a. Hilti Kwik-HUS-EZ, ICC-ESR 3027.
 - b. Powers Wedge Bolt +, ICC- ESR 2526
 - c. Simpson Strong-Tie Titen HD Screw Anchor, ICC-ESR-2713
- C. Heavy Duty Metric Sleeve Anchors: Torque-controlled, exhibiting follow-up expansion under load, with provision for rotation prevention during installation. Type and size as indicated on Drawings.
1. Interior Use: Unless otherwise indicated on the Drawings, provide carbon steel anchors manufactured from materials conforming to ISO 898 Part 1, with zinc plating equivalent to ASTM B633, Type III Fe/Zn 5 (5µm min.).
 2. Exterior Use: As indicated on the Drawings, provide stainless steel anchors. Stainless steel anchors shall be manufactured from materials conforming to ISO 3506 Part 1 and having corrosion resistance equivalent to AISI [Type 304] [and] [Type 316] stainless steel. Stainless steel anchors shall be provided with stainless steel nuts and washers of matching alloy group and minimum proof stress equal to or greater than the specified minimum full-size tensile strength of the externally threaded fastener. All nuts shall conform to ISO 3506 Part 2 unless otherwise specified. Avoid installing stainless steel anchors in contact with galvanically dissimilar metals.
 3. Where anchor manufacturer is not indicated, subject to compliance with requirements and acceptance by the Engineer, provide the following:
 - a. Hilti HSL-3, HSL-3-G, or HSL-3-B, ICC ESR-1545 (carbon steel).
 - b. Simpson Strong-Tie Sleeve-All Anchor (Uncracked concrete only)
- D. Cartridge Injection Adhesive Anchors: Threaded steel rod, inserts or reinforcing dowels, complete with nuts, washers, polymer or hybrid mortar adhesive injection system, and manufacturer's installation instructions. Type and size as indicated on Drawings.
1. Adhesive anchors shall meet the criteria of ACI 355.4
 2. Interior Use: Unless otherwise indicated on the Drawings, provide carbon steel threaded rods conforming to ASTM F1554 Grade 36, ASTM A 193 Type B7 or ISO 898 Class 5.8 with zinc plating in accordance with ASTM B633, Type III Fe/Zn 5 (SC1) [or carbon steel HIT TZ rods conforming to ASTM A510 with chemical composition of AISI 1038].
 3. Exterior Use: As indicated on the Drawings, provide stainless steel anchors. Stainless steel anchors shall be AISI [Type 304] [and] [Type 316] stainless steel provided with stainless steel nuts and washers of matching alloy group and minimum proof stress equal to or greater than the specified minimum full-size tensile strength of the externally threaded fastener. All nuts shall conform to ASTM F594 unless otherwise specified. Avoid installing stainless steel anchors in contact with galvanically dissimilar metals.
 4. Reinforcing dowels shall be A615 Grade 60.
 5. Where anchor manufacturer is not indicated, subject to compliance with requirements and acceptance by the Engineer, provide one of the following:
 - a. Hilti HAS threaded rods with HIT-HY 200 Safe Set System using Hilti Hollow Drill Bit System for anchorage to concrete, ICC ESR-3187.
 - b. Hilti HIT-Z anchor rods with HIT-HY 200 Safe Set System for anchorage to concrete, ICC ESR-3187.
 - c. Powers AC100+ Gold, ICC-ES ESR 2582
 - d. Simpson Strong-Tie SET-XP Epoxy Adhesive, ICC-ES ESR-2508
 - e. Simpson Strong-Tie AT-XP Acrylic Adhesive (decreased installation temperature to 14°F)

2.4 POST INSTALLED ANCHORS IN MASONRY SUBSTRATE

A. Expansion Anchors for Grout-Filled Concrete Masonry Units

1. Expansion anchors are post-installed torque-controlled mechanical expansion anchors used to transmit structural loads by means of tension, shear, or a combination of both between: (a) connected structural elements; or (b) safety-related attachments and structural elements. Anchors shall be assigned allowable tension and shear loads for designs based on allowable stress design in fully grouted concrete masonry units. Such anchors shall be imperial sized, threaded stud with an integral cone expander, expansion clip, nut and washer. The stud shall be manufactured from carbon steel. The expansion clip shall be manufactured from carbon steel. Carbon steel anchors shall have an electroplated zinc finish in accordance with ASTM B633, Class SC1, Type III or shall be mechanically galvanized in accordance with ASTM B695, Class 55, Type 1, as appropriate. Anchors shall have an evaluation report issued by ICC-ES and have been tested and qualified for performance in grout-filled concrete masonry in accordance with ICC-ES AC01 for all mandatory tests.
2. Expansion anchors for grout-filled concrete masonry units shall be:
 - a. Hilti Kwik Bolt 3 Anchor ICC-ES ESR-1385
 - b. Powers Power Stud+ SD1, ICC ESR-2966
 - c. Simpson Strong-Tie Strong-Bolt 2 Wedge Anchor
 - d. Simpson Strong-Tie Wedge-All Anchor, ICC-ES ESR-1396 (carbon steel or mechanically galvanized)

B. Screw Anchors for Grout-Filled Concrete Masonry Units

1. Screw anchors are post-installed concrete anchors used to transmit structural loads by means of tension, shear, or a combination of both between: (a) connected structural elements; or (b) safety-related attachments and structural elements. Anchors shall be assigned allowable tension and shear loads for designs based on allowable stress design in fully grouted concrete masonry units. Anchors shall be manufactured from carbon steel which is subsequently heat-treated. Anchors shall be zinc-plated in accordance with ASTM B633, Class SC1, Type III or shall be mechanically galvanized in accordance with ASTM B695, Class 55, Type 1, as appropriate. Anchors shall have an evaluation report issued by ICC-ES or IAPMO-UES and have been tested and qualified for performance in grout-filled concrete masonry in accordance with ICC-ES AC106 for all mandatory tests.
2. Screw anchors for concrete masonry units shall be:
 - a. Simpson Strong-Tie Titen HD Screw Anchor, ICC-ES ESR-1056

C. Adhesive Anchors for Grout-Filled Concrete Masonry Units

1. An adhesive anchor shall consist of: 1) threaded rod or reinforcing bar insert; and 2) adhesive formula. Threaded rod inserts shall meet the minimum requirements of ASTM F1554 Grade 36, ASTM A193 Grade B7, ASTM A193 Grade B6 (Type 410 Stainless Steel) or ASTM A193 Grade B8 and B8M (Types 304 and 316 Stainless Steel). Reinforcing bar inserts shall meet the minimum requirements of ASTM A615 Grade 40. For exterior exposure the insert shall be stainless steel. Inserts in contact with preservative-treated and fire-retardant-treated wood shall be zinc coated in accordance with ASTM A153 Class C or D or stainless steel or demonstrated through tests to be equivalent to the coatings described. Adhesives shall be injectable, two-component, cartridge-type systems dispensed and mixed through a static mixing nozzle supplied by the manufacturer. Acceptable installation and performance temperature ranges shall be verified with manufacturer's literature prior to installation.
2. Adhesive anchors are post-installed anchors used to transmit structural loads by means of tension, shear, or a combination of both between: (a) connected structural elements; or (b) safety-related attachments and structural elements. Adhesive anchors shall be assigned allowable tension and shear loads for designs based on allowable stress design in fully grouted concrete masonry units. Adhesive anchors shall have an evaluation report issued by ICC-ES and have been tested and

qualified for performance in grout-filled concrete masonry units in accordance ICC-ES AC58 for all mandatory tests.

3. Adhesive anchors for grout-filled concrete masonry units shall be:
 - a. Hilti HIT-HY 270
 - 1) Steel anchor shall be Hilti HAS-E continuously threaded rod or continuously deformed steel rebar
 - b. Powers AC100+ Gold
 - c. Simpson Strong-Tie SET-XP Epoxy Adhesive
 - d. Simpson Strong-Tie AT-XP Acrylic Adhesive
 - e. Simpson Strong-Tie ET-HP Epoxy Adhesive

D. Screw Anchors for Hollow Concrete Masonry Units

1. Screw anchors are post-installed concrete anchors used to transmit medium duty, non-seismic loads to hollow concrete masonry units by means of tension or shear, or a combination of both. Anchors shall be assigned allowable tension and shear loads for designs based on allowable stress design in hollow concrete masonry units. Anchors shall be manufactured from carbon steel which is subsequently heat-treated. Anchors shall be zinc-plated in accordance with ASTM B633, Class SC1, Type III. Anchors shall have been tested and qualified for performance in hollow concrete masonry units.
2. Screw anchors for hollow concrete masonry units shall be:
 - a. Powers Wedge-Bolt+ Screw Anchor, ESR-1678
 - b. Simpson Strong-Tie Titen HD Screw Anchor

E. Adhesive Anchors for Hollow Concrete Masonry Units

1. An adhesive anchor shall consist of: 1) threaded rod insert; 2) adhesive formula; and 3) carbon steel, stainless steel or plastic screen tube. Threaded rod inserts shall meet the minimum requirements of ASTM F1554 Grade 36, ASTM A193 Grade B7, ASTM A193 Grade B6 (Type 410 Stainless Steel) or ASTM A193 Grade B8 and B8M (Types 304 and 316 Stainless Steel). For exterior exposure the insert shall be stainless steel. Inserts in contact with preservative-treated and fire-retardant-treated wood shall be zinc coated in accordance with ASTM A153 Class C or D or stainless steel or demonstrated through tests to be equivalent to the coatings described. Adhesives shall be injectable, two-component, cartridge-type systems dispensed and mixed through a static mixing nozzle supplied by the manufacturer. Acceptable installation and performance temperature ranges shall be verified with manufacturer's literature prior to installation.
2. Adhesive anchors are post-installed anchors used to transmit medium duty, non-seismic loads to hollow concrete masonry units by means of tension, shear, or a combination of both. Adhesive anchors shall be assigned allowable tension and shear loads for designs based on allowable stress design in hollow concrete masonry units. Adhesive anchors shall have been tested and qualified for performance in hollow concrete masonry units.
3. Adhesive anchors for hollow concrete masonry units shall be:
 - a. Hilti HIT-HY 70
 - 1) Steel anchor shall be Hilti HAS-E continuously threaded rod or continuously deformed steel rebar (use with appropriately sized screen tube)
 - b. Simpson Strong-Tie SET Epoxy Adhesive (use carbon steel or plastic screen tube)
 - c. Simpson Strong-Tie AT Acrylic Adhesive (use stainless steel or plastic screen tube)
 - d. Simpson Strong-Tie ET-HP Epoxy Adhesive (use carbon steel or plastic screen tube)

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Install only if environmental conditions are in compliance with manufacturer's recommendations for installation conditions

3.2 PREPARATION

- A. Verify on-site training of installers has been completed
- B. Identify position of reinforcing steel and other embedded items prior to drilling holes for anchors.
 - 1. Existing reinforcing bars in the structure may conflict with specific anchor locations. Unless noted on the drawings that the bars can be cut, the contractor shall review the existing structural drawings and shall undertake to locate the position of the reinforcing bars at the locations of the post installed anchors by Hilti Ferrosan, GPR, X-RAY, chipping, or other means.
 - 2. Exercise care in drilling to avoid damaging existing reinforcing or embedded items.
 - 3. Notify the Engineer if reinforcing steel or other embedded items are encountered during drilling.
 - 4. DO NOT DRILL THROUGH REINFORCING without first contacting the Engineer of Record.
 - 5. Take precautions as necessary to avoid damaging prestressing tendons, electrical and telecommunications conduit, and gas lines.
- C. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.
- D. Clean holes for post installed anchors per MPII
 - 1. Where holes are drilled and cleaned in advance of anchor installation, it must be verified that the holes are protected from intrusion of contaminants or moisture (e.g., rainwater) during the interim period, or that the cleaning steps are performed immediately prior to anchor installation.
- E. Proceed with installation only after unsatisfactory conditions have been corrected.

3.3 INSTALLATION

- A. General
 - 1. Adhesive anchors shall be installed in concrete having a minimum age of 21 days at time of anchor installation.
 - 2. Anchor capacity is dependent upon spacing between adjacent anchors and proximity of anchors to edge of concrete or masonry. Install anchors in accordance with spacing and edge clearances indicated on the drawings.
- B. Perform anchor installation in accordance with MPII.
- C. Where manufacturer recommends use of special tools for installation of anchors, such tools shall be used, unless otherwise permitted specifically by the Engineer of Record.
- D. Expansion Anchors, Heavy-Duty Sleeve Anchors, and Undercut Anchors: Protect threads from damage during anchor installation. Heavy-duty sleeve anchors shall be installed with sleeve fully engaged in part to be fastened. Set anchors to manufacturer's recommended torque, using a torque wrench. Following attainment of 10% of the specified torque, 100% of the specified torque shall be reached within 7 or

fewer complete turns of the nut. If the specified torque is not achieved within the required number of turns, the anchor shall be removed and replaced unless otherwise directed by the Engineer.

- E. Drill holes for adhesive anchors with rotary impact hammer drills using carbide-tipped bits, or hollow drill bit system. Cored holes are not permitted for adhesive anchor applications. Drill bits shall be of diameters as specified by the anchor manufacturer. Unless otherwise shown on the Drawings, all holes shall be drilled perpendicular to the concrete surface.
 - 1. Cored Holes: Do not use cored holes for adhesive anchors. Where anchors are permitted to be installed in cored holes, use core bits with matched tolerances as specified by the manufacturer. Properly clean cored hole per manufacturer's instructions.
 - 2. Base Material Strength: Unless otherwise specified, do not drill holes in concrete or masonry until concrete, mortar, or grout has achieved full design strength.
- F. Cartridge Injection Adhesive Anchors:
 - 1. Clean all holes per manufacturer instructions to remove loose material and drilling dust prior to installation of adhesive.
 - 2. Inject adhesive into holes proceeding from the bottom of the hole and progressing toward the surface in such a manner as to avoid introduction of air pockets in the adhesive.
 - 3. Follow manufacturer recommendations to ensure proper mixing of adhesive components. Sufficient adhesive shall be injected in the hole to ensure that the annular gap is filled to the surface. Remove excess adhesive from the surface.
 - 4. Shim anchors with suitable device to center the anchor in the hole.
 - 5. Do not disturb or load anchors before manufacturer specified cure time has elapsed.
- G. Overhead adhesive anchors must be installed using the Hilti Profi System
- H. Observe manufacturer recommendations with respect to installation temperatures for cartridge injection adhesive anchors.

3.4 FIELD QUALITY CONTROL

- A. The Architect/Engineer reserves the right to require the anchor manufacturer's representative to demonstrate proper installation procedures for post-installed anchors and to observe Contractor's installation procedures, at no extra cost to Owner.
- B. The Architect/Engineer reserves the right to require pullout or shear tests to determine adequacy of anchors, at no extra cost to Owner.
- C. Special Inspections – Owner will engage a qualified special inspector to perform the following special inspections:
 - 1. Continuous special inspection – The special inspector shall observe all aspects of the anchor installation with the exception of holes drilled in the absence of the special inspector, provided the special inspector examines the drill bits used for the drilling and verifies the hole sizes.
 - 2. Periodic special inspection – The special inspector shall verify the initial installation of each type and size of adhesive anchor by construction personnel on site in accordance with the items noted in the sections below. Subsequent installations of the same anchor type and size by the same construction personnel shall be permitted to be performed in the absence of the special inspector. Any change in the anchor product being installed or the personnel performing the installation shall require an initial special inspection in accordance with the requirements below. For ongoing installations over an extended period, the special inspector shall make regular inspections to confirm correct handling and installation of the product.
 - 3. Mechanical Anchors – Periodically inspect and verify the following items:
 - a. Hole drilling method in accordance with MPII

- b. Anchor edge distance and spacing
 - c. Hole diameter and depth
 - d. Hole cleaning in accordance with the MPII
 - e. Anchor element type, material, diameter, and length
 - f. Where anchors are installed in a slab on grade, check that the hole drilling procedures do not result in breaking through to the underside of the slab.
 - g. Torque wrenches are calibrated properly
 - h. Anchor threads are undamaged and not fouled
 - i. During setting of torque-controlled expansion anchors, the inspector will note the number of full turns required to achieve the required torque
4. Cartridge injection Adhesive Anchors – Periodically inspect and verify the following items:
- a. Minimum concrete cure time of 21 days has passed
 - b. Hole drilling method in accordance with MPII
 - c. Anchor edge distance and spacing
 - d. Hole diameter and depth
 - e. Hole cleaning in accordance with the MPII
 - f. Anchor element type, material, diameter, and length
 - g. Anchor elements (threaded rod, reinforcing bars, internally threaded sleeves) are free of substances that might interfere with bond (e.g., dust, mud, oil)
 - h. Reinforcing bars are free of loose rust
 - i. Anchor threads are undamaged and not fouled
 - j. Concrete temperature in-situ verified prior to installation for conformance with the requirements of the MPII and to establish the cure time for the adhesive
 - k. Adhesive identification and expiration date
 - l. Adhesive installation in accordance with MPII
 - m. Anchor position is true (angle with respect to the concrete surface), and that the anchor is secured against movement during the cure time
5. Additional requirements for adhesive anchors installed in horizontal (overhead) or upwardly inclined orientations:
- a. Installations of adhesive anchors that resist sustained tension must be performed by certified adhesive anchor installers.
 - b. Certification shall include written and performance tests in accordance with the ACI/CRSI Adhesive Anchor Installer Certification program, or equivalent.
 - c. Special inspector shall verify that personnel performing adhesive anchor installations in these conditions are experienced and qualified to use the specific adhesive anchor system being employed.
- D. Proof loading of mechanical anchors (except screw anchors): 10% of each type and size of post installed anchor shall be proof loaded by the independent testing laboratory.
- 1. Tension testing should be performed in accordance with ASTM E488.
 - a. Proof load levels shall not exceed 80 percent of the anchor yield strength.
 - b. Maintain the proof load for a minimum of 10 seconds.
 - 2. Torque shall be applied with a calibrated torque wrench.
 - 3. Proof loads shall be applied by placing a loading shoe under the anchor head or threading a coupler onto the anchor stud.
 - 4. If any of the tested anchors fail to achieve the specified torque or proof load within the limits as defined on the Drawings, all anchors of the same diameter and type as the failed anchor shall be tested, unless otherwise instructed by the Engineer.
 - a. Continuous inspection, as defined above, shall be performed by the special inspector, until which time the special inspector is satisfied with the installer's corrected procedures.
 - 5. There shall be no discernible movement of the anchor

- E. Proof loading of adhesive anchors: 10% of each type and size of post installed anchor shall be proof loaded by the independent testing laboratory. Adhesive anchors shall not be torque tested unless otherwise directed by the Engineer.
 - 1. Tension testing should be performed in accordance with ASTM E488.
 - a. Proof load levels shall not exceed the lesser of 50 percent of the expected peak load based on adhesive bond strength or 80 percent of the anchor yield strength.
 - b. Maintain the proof load for a minimum of 10 seconds.
 - 2. Proof loads shall be applied with a calibrated hydraulic ram. Displacement of adhesive and capsule anchors at proof load shall not exceed $D/10$, where D is the nominal anchor diameter.
 - 3. If any of the tested anchors fail to achieve the proof load within the limits as defined on the Drawings, all anchors of the same diameter and type as the failed anchor shall be tested, unless otherwise instructed by the Engineer.
 - a. Continuous inspection, as defined above, shall be performed by the special inspector, until which time the special inspector is satisfied with the installer's corrected procedures.

3.5 REPAIR OF DEFECTIVE WORK

- A. Remove and replace misplaced or malfunctioning anchors. Fill empty anchor holes and patch failed anchor locations with high-strength non-shrink, nonmetallic grout. Anchors that fail to meet proof load or installation torque requirements shall be regarded as malfunctioning.

END OF SECTION 050523

SECTION 051200 - STRUCTURAL STEEL FRAMING

PART 1 - GENERAL

When the information in this Specification Section conflicts with information on the Structural Construction Drawings, the Structural Construction Drawings shall prevail.

1.1 SUMMARY

A. Section Includes:

1. Structural steel.
2. Grout.

B. Related Requirements:

1. Section 051213 "Architecturally Exposed Structural Steel Framing" for additional requirements for architecturally exposed structural steel.
2. Section 055000 "Metal Fabrications" for steel lintels and shelf angles not attached to structural-steel frame, miscellaneous steel fabrications, and other steel items not defined as structural steel.

1.2 DEFINITIONS

- A. Structural Steel: Elements of the structural frame indicated on Drawings and as described in AISC 303-10, "Code of Standard Practice for Steel Buildings and Bridges."

1.3 COORDINATION

- A. Coordinate selection of shop primers with topcoats to be applied over them. Comply with paint and coating manufacturers' written recommendations to ensure that shop primers and topcoats are compatible with one another.
- B. Coordinate installation of anchorage items to be embedded in or attached to other construction without delaying the Work. Provide setting diagrams, sheet metal templates, instructions, and directions for installation.

1.4 PREINSTALLATION MEETINGS

- A. A pre-installation meeting with the Contractor, Steel Erector, Special Inspector and Architect is required.
1. Meeting shall be held at the job site trailer or other mutually agreed upon location.
 2. Contact Architect at least two (2) weeks prior to steel installation to arrange meeting date.
 3. An approved Structural Steel Submittal Package shall be completed prior to arrangement of pre-installation meeting.

1.5 ACTION SUBMITTALS

- A. Shop Drawings: Show fabrication of structural-steel components.

1. Include details of cuts, connections, splices, camber, holes, and other pertinent data.
 2. Include Embedment Drawings for steel elements embedded in masonry or concrete.
 3. Indicate welds by standard AWS symbols, distinguishing between shop and field welds, and show size, length, and type of each weld. Show backing bars that are to be removed and supplemental fillet welds where backing bars are to remain.
 4. Indicate type, size, and length of bolts, distinguishing between shop and field bolts. Identify pretensioned and slip-critical, high-strength bolted connections.
 5. Erection Drawings
- B. No allowance has been made for redmarking a quantity of hardcopies. Fees for in-house duplication of redmarks on printed hardcopies may be an Additional Service and invoiced at an hourly rate using Shell + Meyer's Standard Rate Schedule
- C. The fee to use Shell + Meyer's drawings to develop structural shop drawings is \$50.00 per sheet requested. The fee is charged directly to the sub-contractor who requests the files.
- D. Submittals requiring more than TWO (2) reviews by SMA resulting from errors and omissions of the supplier's detailer will be an Additional Service and invoiced at an hourly rate. An invoice for these services will be attached to the final approved set of shop drawings.
- E. Welding Procedure Specifications (WPSs) and Procedure Qualification Records (PQRs) for Partial Joint Penetration (PJP), Complete Joint Penetration (CJP), and flare bevel groove welds: Provide according to AWS D1.1/D1.1M, "Structural Welding Code - Steel," for each welded joint whether prequalified or qualified by testing, including the following:
1. Power source (constant current or constant voltage).
 2. Electrode manufacturer and trade name.

1.6 INFORMATIONAL SUBMITTALS

- A. Fabricator Qualifications:
1. Copy of AISC Certification Program certificate.
- B. Welding certificates.
- C. Source quality-control reports to be submitted one week prior to scheduled delivery.
- D. Field quality-control and special inspection reports.

1.7 QUALITY ASSURANCE

- A. Fabricator Qualifications:
1. 5 years minimum experience
 2. A qualified fabricator that participates in the AISC Certification Program and is designated an AISC-Certified Plant, Category BU at time of bid.
 - a. In lieu of using an AISC Certified Fabricator, the general contractor shall submit a waiver (see Shell & Meyer Associates for copy) and shall reimburse the Owner for all required special inspections pertaining to fabrication.
 - b. Budget no less than 2 hours plus travel time of special inspection per day of fabrication to have the Owner's 3rd Party Special Inspector present at the fabricator's facility to inspect the progress. Increase the number of hours as required for any continuous inspection activities.

- B. Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."
- C. Comply with applicable provisions of the following specifications and documents:
 - 1. AISC 303-10 "Code of Standard Practice for Steel Buildings and Bridges."
 - 2. AISC 360-10 "Specification for Structural Steel Buildings."
 - 3. RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts."

1.8 DELIVERY, STORAGE, AND HANDLING

- A. Store materials to permit easy access for inspection and identification. Keep steel members off ground and spaced by using pallets, dunnage, or other supports and spacers. Protect steel members and packaged materials from corrosion and deterioration.
 - 1. Do not store materials on structure in a manner that might cause distortion, damage, or overload to members or supporting structures. Repair or replace damaged materials or structures as directed.
- B. Store fasteners in a protected place in sealed containers with manufacturer's labels intact.
 - 1. Fasteners may be repackaged provided Owner's testing and inspecting agency observes repackaging and seals containers.
 - 2. Clean and relubricate bolts and nuts that become dry or rusty before use.
 - 3. Comply with manufacturers' written recommendations for cleaning and lubricating ASTM F 1852 fasteners and for retesting fasteners after lubrication.

1.9 COORDINATION

- A. Coordinate selection of shop primers with topcoats to be applied over them. Comply with paint and coating manufacturers' recommendations to ensure that shop primers and topcoats are compatible with one another.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Connections: Provide details of simple shear connections required by the Contract Documents to be selected or completed by structural-steel fabricator to withstand loads indicated and comply with other information and restrictions indicated.
 - 1. Select and complete connections using schematic details indicated and AISC 360.
 - 2. Use Allowable Stress Design; data are given at service-load level.

2.2 STRUCTURAL-STEEL MATERIALS

- A. W-Shapes: ASTM A 992.
- B. Channels, Angles, M-Shapes: ASTM A 36.

- C. Plate and Bar: ASTM A 36.
- D. Hollow Structural Sections: ASTM A 500 Grade C, structural tubing.
- E. Steel Pipe: ASTM A 500 Grade C, structural tubing.
- F. Welding Electrodes:
 - 1. Use E70XX electrode unless noted otherwise.
 - 2. Comply with AWS requirements.

2.3 BOLTS, CONNECTORS, AND ANCHORS

- A. Tension-Control, High-Strength Bolt-Nut-Washer Assemblies: ASTM F 1852, Type 1, round head assemblies consisting of steel structural bolts with splined ends, heavy-hex carbon-steel nuts, and hardened carbon-steel washers.
 - 1. Use as default bolt unless noted otherwise.
 - 2. Finish: Plain.
- B. Zinc-Coated High-Strength Bolts, Nuts, and Washers: ASTM A 325, Type 1, heavy-hex steel structural bolts; ASTM A 563, Grade DH heavy-hex carbon-steel nuts; and ASTM F 436, Type 1, hardened carbon-steel washers.
 - 1. Finish: Hot-dip or mechanically deposited zinc coating.
 - 2. Direct-Tension Indicators: ASTM F 959, Type 325, compressible-washer type with mechanically deposited zinc coating finish.
- C. Unheaded Anchor Rods: ASTM F 1554, Grade 36, U.N.O.
 - 1. Configuration: Straight.
 - 2. Nuts: ASTM A 563 heavy-hex carbon steel.
 - 3. Plate Washers: ASTM A 36 carbon steel.
 - 4. Washers: ASTM F 436, Type 1, hardened carbon steel.
 - 5. Finish: Plain.
- D. Threaded Rods: ASTM A 36.
 - 1. Nuts: ASTM A 563 heavy-hex carbon steel.
 - 2. Washers: ASTM F 436, Type 1, hardened carbon steel.
 - 3. Finish: Plain.
- E. Clevises and Turnbuckles: Made from cold-finished carbon steel bars, ASTM A 108, Grade 1035.
- F. Eye Bolts and Nuts: Made from cold-finished carbon steel bars, ASTM A 108, Grade 1030.
- G. Sleeve Nuts: Made from cold-finished carbon steel bars, ASTM A 108, Grade 1018.

2.4 PRIMER

- A. Low-Emitting Materials: Paints and coatings shall comply with the testing and product requirements of the California Department of Public Health's (formerly, the California Department of Health Services')

"Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."

- B. Primer: Fabricator's standard lead- and chromate-free, nonasphaltic, rust-inhibiting primer complying with MPI#79 and compatible with topcoat.
- C. Galvanizing Repair Paint: MPI#18, MPI#19, ASTM A780, or SSPC-Paint 20.

2.5 GROUT

- A. Nonmetallic, Shrinkage-Resistant Grout: ASTM C 1107, factory-packaged, nonmetallic aggregate grout, noncorrosive and nonstaining, mixed with water to consistency suitable for application and a 30-minute working time.

2.6 FABRICATION

- A. Structural Steel: Fabricate and assemble in shop to greatest extent possible. Fabricate according to AISC 303, "Code of Standard Practice for Steel Buildings and Bridges," and to AISC 360.
 - 1. Camber structural-steel members where indicated.
 - 2. Fabricate beams with rolling camber up.
 - 3. Identify high-strength structural steel according to ASTM A 6 and maintain markings until structural steel has been erected.
 - 4. Mark and match-mark materials for field assembly.
 - 5. Complete structural-steel assemblies, including welding of units, before starting shop-priming operations.
- B. Thermal Cutting: Perform thermal cutting by machine to greatest extent possible.
 - 1. Plane thermally cut edges to be welded to comply with requirements in AWS D1.1/D1.1M.
- C. Bolt Holes: Cut, drill, or punch bolt holes perpendicular to metal surfaces.
- D. Finishing: Accurately finish ends of columns and other members transmitting bearing loads.
- E. Cleaning: Clean and prepare steel surfaces that are to remain unpainted according to SSPC-SP 2, "Hand Tool Cleaning."
- F. Install headed studs on all structural steel beams supporting Concrete Masonry Units directly on the beam's top flange.
- G. Holes: Provide holes required for securing other work to structural steel and for other work to pass through steel members.
 - 1. Cut, drill, or punch holes perpendicular to steel surfaces. Do not thermally cut bolt holes or enlarge holes by burning.
 - 2. Baseplate Holes: Cut, drill, mechanically thermal cut, or punch holes perpendicular to steel surfaces.
- H. Closure Plates: Provide minimum 1/4 inch closure plates at all Hollow Structural Steel tube ends, U.N.O. on plans.

2.7 SHOP CONNECTIONS

- A. High-Strength Bolts: Shop install high-strength bolts according to RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts" for type of bolt and type of joint specified.
 - 1. Joint Type: Pretensioned.
- B. Weld Connections: Comply with AWS D1.1 for tolerances, appearances, welding procedure specifications, weld quality, and methods used in correcting welding work.
 - 1. Assemble and weld built-up sections by methods that maintain true alignment of axes without exceeding tolerances in AISC 303 for mill material.

2.8 SHOP PRIMING

- A. Shop prime steel surfaces except the following:
 - 1. Surfaces embedded in concrete or mortar. Extend priming of partially embedded members to a depth of 2 inches.
 - 2. Surfaces to be field welded.
 - 3. Surfaces of high-strength bolted, slip-critical connections.
 - 4. Surfaces to receive sprayed fire-resistive materials (applied fireproofing).
 - 5. Galvanized surfaces.
 - 6. Surfaces enclosed in interior construction.
- B. Surface Preparation: Clean surfaces to be painted. Remove loose rust and mill scale and spatter, slag, or flux deposits. Prepare surfaces according to the following specifications and standards:
 - 1. SSPC-SP 2, "Hand Tool Cleaning."
 - 2. SSPC-SP 3, "Power Tool Cleaning."
- C. Priming: Immediately after surface preparation, apply primer according to manufacturer's written instructions and at rate recommended by SSPC to provide a minimum dry film thickness of 1.5 mils. Use priming methods that result in full coverage of joints, corners, edges, and exposed surfaces.

2.9 GALVANIZING

- A. Hot-Dip Galvanized Finish: Apply zinc coating by the hot-dip process to structural steel according to ASTM A 123/A 123M.
 - 1. Fill vent and drain holes that are exposed in the finished Work unless they function as weep holes, by plugging with zinc solder and filing off smooth.
 - 2. Galvanize lintels shelf angles and welded door frames attached to structural-steel frame and located in exterior walls.

2.10 SOURCE QUALITY CONTROL

- A. Testing Agency: Owner will engage a qualified testing agency to perform shop tests and inspections.

1. Provide testing agency with access to places where structural-steel work is being fabricated or produced to perform tests and inspections.
- B. Bolted Connections: Inspect and test shop-bolted connections according to RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts."
- C. Welded Connections: In addition to visual inspection, shop-welded connections will be tested according to AWS D1.1 and the following inspection procedures:
 1. Liquid Penetrant Inspection: ASTM E 165.
 2. Magnetic Particle Inspection: ASTM E 709; performed on root pass and on finished weld. Cracks or zones of incomplete fusion or penetration are not accepted.
 3. Ultrasonic Inspection: ASTM E 164.
 4. Radiographic Inspection: ASTM E 94.
- D. Prepare test and inspection reports.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verify, with certified steel erector present, elevations of concrete- and masonry-bearing surfaces and locations of anchor rods, bearing plates, and other embedments for compliance with requirements.
 1. Prepare a certified survey of existing conditions. Include bearing surfaces, anchor rods, bearing plates, and other embedments showing dimensions, locations, angles, and elevations.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Provide temporary shores, guys, braces, and other supports during erection to keep structural steel secure, plumb, and in alignment against temporary construction loads and loads equal in intensity to design loads. Remove temporary supports when permanent structural steel, connections, and bracing are in place unless otherwise indicated.

3.3 COORDINATION

- A. Coordinate installation of anchorage items to be embedded in or attached to other construction without delaying the Work. Provide setting diagrams, sheet metal templates, instructions, and directions for installation.

3.4 ERECTION

- A. Set structural steel accurately in locations and to elevations indicated and according to AISC 303 and AISC 360.

- B. Baseplates Bearing Plates and Leveling Plates: Clean concrete- and masonry-bearing surfaces of bond-reducing materials, and roughen surfaces prior to setting plates. Clean bottom surface of plates.
 - 1. Set plates for structural members on wedges, shims, or setting nuts as required.
 - 2. Weld plate washers to top of baseplate.
 - 3. Snug-tighten anchor rods after supported members have been positioned and plumbed. Do not remove wedges or shims but, if protruding, cut off flush with edge of plate before packing with grout.
 - 4. Promptly pack grout solidly between bearing surfaces and plates so no voids remain. Neatly finish exposed surfaces; protect grout and allow to cure. Comply with manufacturer's written installation instructions for shrinkage-resistant grouts.
- C. Maintain erection tolerances of structural steel within AISC 303, "Code of Standard Practice for Steel Buildings and Bridges."
- D. Align and adjust various members that form part of complete frame or structure before permanently fastening. Before assembly, clean bearing surfaces and other surfaces that are in permanent contact with members. Perform necessary adjustments to compensate for discrepancies in elevations and alignment.
 - 1. Level and plumb individual members of structure.
 - 2. Make allowances for difference between temperature at time of erection and mean temperature when structure is completed and in service.
- E. Splice members only where indicated.
- F. Do not use thermal cutting during erection.
- G. Do not enlarge unfair holes in members by burning or using drift pins. Ream holes that must be enlarged to admit bolts.
- H. Shear Connectors: Prepare steel surfaces as recommended by manufacturer of shear connectors. Use automatic end welding of headed-stud shear connectors according to AWS D1.1 and manufacturer's written instructions.

3.5 FIELD CONNECTIONS

- A. High-Strength Bolts: Install high-strength bolts according to RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts" for type of bolt and type of joint specified.
 - 1. Joint Type: Snug tightened.
- B. Weld Connections: Comply with AWS D1.1 for tolerances, appearances, welding procedure specifications, weld quality, and methods used in correcting welding work.
 - 1. Comply with AISC 303 and AISC 360 for bearing, alignment, adequacy of temporary connections, and removal of paint on surfaces adjacent to field welds.
 - 2. Assemble and weld built-up sections by methods that maintain true alignment of axes without exceeding tolerances in AISC 303, "Code of Standard Practice for Steel Buildings and Bridges," for mill material.
 - 3. Remove backing bars exposed to view, back gouge, and grind welds smooth.

3.6 FIELD QUALITY CONTROL

- A. Inspection: Owner will engage a qualified inspector to perform the following inspections:
 - 1. Verify structural-steel materials and inspect steel frame joint details.
 - 2. Verify weld materials and inspect welds.
 - 3. Verify connection materials and inspect high-strength bolted connections.
 - 4. See Contract Drawings for Special Inspection requirements, if required.
- B. Bolted Connections: Inspect bolted connections according to RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts."
- C. Welded Connections: Visually inspect field welds according to AWS D1.1.
 - 1. In addition to visual inspection, test and inspect field welds according to AWS D1.1 and the following inspection procedures, at Special Inspector's option:
 - a. Liquid Penetrant Inspection: ASTM E 165.
 - b. Magnetic Particle Inspection: ASTM E 709; performed on root pass and on finished weld. Cracks or zones of incomplete fusion or penetration are not accepted.
 - c. Ultrasonic Inspection: ASTM E 164.
 - d. Radiographic Inspection: ASTM E 94.
 - 2. 100% of groove welds shall have non-destructive testing
- D. Correct deficiencies in Work that test reports and inspections indicate does not comply with the Contract Documents.

3.7 REPAIRS AND PROTECTION

- A. Galvanized Surfaces: Clean areas where galvanizing is damaged or missing and repair galvanizing to comply with ASTM A 780.
- B. Touchup Painting: Immediately after erection, clean exposed areas where primer is damaged or missing and paint with the same material as used for shop painting to comply with SSPC-PA 1 for touching up shop-painted surfaces.
 - 1. Clean and prepare surfaces by SSPC-SP 2 hand-tool cleaning or SSPC-SP 3 power-tool cleaning.

END OF SECTION 051200

SECTION 053100 - STEEL DECKING

PART 1 - GENERAL

When the information in this Specification Section conflicts with information on the Structural Construction Drawings, the Structural Construction Drawings shall prevail.

1.1 SUMMARY

- A. Section Includes:
 - 1. The extent of steel deck shown on the Drawings including type of deck, layout and orientation.
 - 2. Welds and mechanical fastener types, sizes and patterns.
- B. Related Requirements:
 - 1. Section 033000 "Cast-in-Place Concrete" for concrete on steel deck
 - 2. Section 051200 "Structural Steel Framing" for structural steel of the Primary Structural System
 - 3. Section 055000 "Metal Fabrications" for framing deck openings and perimeter deck supports with miscellaneous steel shapes
 - 4. Section 099123 "Interior Painting" for repair painting of primed deck and finish painting of deck

1.2 DEFINITIONS

- A. Terms not defined in this Specification, AISI S100 or AISI/AISC shall have the ordinary accepted meaning for the context for which they are intended.
- B. Base Material – The existing part of the work that is a base for the fastening. The structural steel or bar joist framing members in steel deck applications
- C. Button Punch – A mechanical means of connecting two pieces of sheet metal together by crimping with a special tool. Unless noted otherwise, button punching shall not be permitted.
- D. Diaphragm Deck – A decking system which is designed to carry lateral loads due to wind or seismic action in addition to gravity loads and wind uplift.
- E. Endlap – The overlap of adjacent steel deck panels at the ends of the panels (end edges perpendicular to the steel deck fluting).
- F. Fastener Pattern – The number and spacing of fasteners at each support for a steel deck panel.
- G. Interlocking Sidelap (BI Connection) – Steel deck panels having male and female side edges. The adjacent deck panel male and female edges interlock into each other when the deck is installed. The interlocks are fastened together using button punches, proprietary punch systems, welds, or screws. Unless noted otherwise, interlocking sidelaps shall not be permitted.
- H. Nestable Sidelap – Steel deck type in which the side edge of the steel deck panel contains a partial valley profile and overlaps, or "nests" on top of the side edge of the adjacent steel deck panel, which contains a full valley profile.
- I. Pullout – As related to fasteners, a failure mode that occurs when the fastener pulls out of the base steel support

- J. Pullover – As related to fasteners, a failure mode that occurs when the steel deck panel pulls over the fastener head or washer(s).
- K. Sidelap – The side edge overlap of adjacent steel panels (side edges parallel to the steel deck panel fluting).
- L. Tack Weld – A weld of no structural significance. Used for temporary attachment of steel to the supporting frame. A weld made to hold the parts in proper alignment until the final welds are made.
- M. Uplift – Vertical load on the steel deck panels due to wind forces

1.3 REFERENCES

- A. American Concrete Institute
 - 1. ACI 318-14, Building Code Requirements for Structural Concrete
- B. American Society for Testing and Materials (ASTM):
 - 1. ASTM A572 – Standard Specification for High-Strength Low-Alloy Columbium-Vanadium Structural Steel
 - 2. ASTM A653 – Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process
 - 3. ASTM A1008 - 08a, Standard Specification for Steel, Sheet, Cold-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, Solution Hardened, and Bake Hardenable
 - 4. ASTM B633 – Standard Specification for Electrodeposited Coatings of Zinc on Iron and Steel
 - 5. ASTM C423 – Standard Test Method for Sound Absorption and Sound Absorption Coefficients by the Reverberation Room Method
- C. American Institute of Steel and Iron (AISI):
 - 1. AISI S100-07 w/S2-10, North American Specification for the Design of Cold-Formed Steel Structural Members, Including Supplement 2 (February 2010)
 - 2. AISI S905-08, Test Methods for Mechanically Fastened Cold-Formed Steel Connections
 - 3. AISI S907-08, Test Standard for Cantilever Test Method for Cold Formed Steel Diaphragms
- D. American National Standards Institute (ANSI)
 - 1. Safety Requirements for Powder-Actuated Fastening Systems (ANSI A10.3)
- E. American Welding Society (AWS):
 - 1. Structural Welding Code – Steel (D1.1)
 - 2. Structural Welding Code – Sheet Steel (D1.3-2008)
- F. Factory Mutual (FM):
 - 1. Building Materials Approval Directory
 - 2. Standard Class No. 4450 – Class I Insulated Steel Roof Decks
- G. International Code Council Evaluation Service (ICC-ES):
 - 1. Acceptance Criteria for Steel Deck Roof and Floor Systems (AC43)
 - 2. Steel Deck Diaphragms Attached with Hilti X-HSN 24 or X-ENP-19 L15 Power-Driven Fasteners and Hilti S-SLC 01 M HWH and S-SLC 02 M HWH Sidelap Connectors (ESR-2776)
 - 3. Bare Steel Deck and Concrete-Filled Steel Deck Diaphragms Attached with Hilti X-ENP-19 L15 or X-HSN 24 Fasteners (ESR-2197)

- H. Steel Deck Institute (SDI):
 - 1. "Code of Standard Practice" COSP-2014
 - 2. "Standard for Steel Roof Deck" RD-2010
 - 3. "Standard for Non-Composite Steel Floor Deck" NC-2010
 - 4. "Standard for Composite Steel Floor Deck Slabs" C-2011
 - 5. "Roof Deck Design Manual" RDDM-2013 – First Edition
 - 6. "Floor Deck Design Manual" FDDM-2014 – First Edition
 - 7. "Diaphragm Design Manual – Design Manual for Composite Decks, Form Decks and Roof Decks", 3rd Edition and Appendix V (Including 2006 and 2013 Addendums)
 - 8. "Manual of Construction with Steel Deck", Second Edition (MOC2) – 2006
 - 9. "Standard for Quality Control and Quality Assurance for the Installation of Steel Deck", as modified by Table C-1 contained in the Commentary to that Standard, QA/QC – 2011
 - 10. Standard Practice Details, SPD-2 – 2001
 - 11. Deck Damage and Penetrations, DDP – 2000

- I. Underwriters Laboratories (UL):
 - 1. Roofing Materials and Systems Directory
 - 2. Fire Resistance Directory, Volume 1
 - 3. UL Standard 580 – Tests for Uplift Resistance of Roof Assemblies

- J. Wire Reinforcement Institute (WRI):
 - 1. Manual of Standard Practice, Eighth Edition, 2010

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of deck, accessory, and product indicated.

- B. Shop Drawings:
 - 1. Deck layout and orientation, supporting steel framing and supports with dimensions and section details.
 - 2. Deck type and profile, dimensions, supports, projections, and cut deck openings.
 - 3. Reinforcing channels, pans, special jointing, accessories, and attachments to other construction.
 - 4. Welds and mechanical fastener types, sizes and patterns.
 - 5. Sidelap connector types, sizes and patterns.
 - 6. Accessory details

1.5 INFORMATIONAL SUBMITTALS

- A. The following documents shall be made available in electronic form to the Designer for review prior to installation of the deck
 - 1. Manufacturer's Published Installation Instructions and product data sheets, catalogue data, or independent evaluation reports (ICC-ESR) for mechanical fasteners
 - 2. Product Certificates: For each type of steel deck.
 - 3. Manufacturer's data for welding consumables
 - 4. Manufacturer's product data sheets or catalog data for welding filler metals and fluxes to be used. The data sheets shall describe the product, limitations of use, recommended or typical welding parameters, and storage and exposure requirements, including baking, if applicable.
 - 5. Welding Procedure Specifications (WPS)
 - 6. Procedure Qualification Records (PQR) for WPS that are not prequalified in accordance with AWS D1.1 or AWS D1.3, as applicable.
 - 7. Welding Personnel Performance Qualification Records (WPQR)
 - 8. Installer's Quality Control Program (QCP)
 - 9. Installer's QC Inspector qualifications

10. Field quality-control reports.

1.6 QUALITY ASSURANCE

- A. Quality Control and Quality Assurance for steel deck installation shall be in accordance with SDI QA/QC 2011, "Standard for Quality Control and Quality Assurance for the Installation of Steel Deck", as modified by Table C-1 contained in the Commentary to that Standard.
- B. Manufacturer Qualifications:
 - 1. Steel Roof Deck Manufacturer: Member producer of SDI.
 - 2. Mechanical Fastener Manufacturer: Member producer of SDI and ISO 9001 accredited for manufacturing quality control.
- C. Testing Agency Qualifications: Qualified according to ASTM E 329 for testing indicated.
- D. Welding Qualifications: All steel roof deck welders AWS certified for welding of sheet steel according to AWS D1.3, "Structural Welding Code - Sheet Steel."
- E. Mechanical Fastener Installers: All mechanical fastener installers certified or licensed by the fastener and tool system manufacturer on the project site in accordance with ANSI A10.3 requirements. Certification or licensing includes all training necessary for proper tool operation, fastener selection, maintenance and troubleshooting.
- F. Comply with all manufacturer catalog and carton installation instructions, product data and technical bulletins.
- G. Pre-Installation Meeting:
 - 1. Installer shall demonstrate workmanship by conducting representative fastenings and welds at pre-installation meeting subject to guidance from mechanical fastener manufacturer.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Steel Deck:
 - 1. Do not rack, bend or mar steel deck sheets.
 - 2. Store steel deck sheets and accessories above ground and protected from free weathering with one end elevated to provide drainage.
 - 3. Cover with waterproof covering and ventilate to avoid condensation until final installation.
 - 4. Architecturally exposed steel deck sheets shall be appropriately packaged or protected to prevent damage during delivery, storage and handling.
- B. Welding Electrodes, Mechanical Fasteners, and Sidelap Connectors
 - 1. Store welding electrodes, mechanical fasteners and powder-actuated cartridges in original packages in a cool, dry location until final installation.
 - 2. Comply with all project and national safety regulations regarding handling of welding equipment and powder-actuated fastening systems.
- C. Acoustical Batts: When open rib acoustical deck is provided, any sound absorbing acoustical batts provided shall be stored at the jobsite in such a manner as to ensure protection until installation. If acoustical batts become wet, they shall be allowed to thoroughly dry without being compressed before installation or shall be replaced if contaminated.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. AISI Specifications: Comply with calculated structural characteristics of steel deck according to AISI's "North American Specification for the Design of Cold-Formed Steel Structural Members."
- B. The steel roof deck is used as part of the horizontal bracing system and the fastening method and pattern have been selected to provide a certain strength and stiffness in the plane of the deck. NO SUBSTITUTION of fastener type or pattern shall be made without the approval of the Structural Engineer of Record.
- C. Substitution requests shall be submitted with the following information indicating the values meet or exceed the weld or fastener capacity of that specified in the Structural Drawings.
 - 1. Weld and mechanical fastener performance data including ultimate tension and shear loads and flexibility factors.
- D. Refer to Part 3, "Concrete Placement" Article of this Section for design construction live loads.

2.2 ACCEPTABLE MANUFACTURERS

- A. Steel Deck: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - 1. [Consolidated Systems, Inc.; Metal Dek Group.](#)
 - 2. [Epic Metals Corporation.](#)
 - 3. [New Millennium Building Systems, LLC.](#)
 - 4. [Nucor Corp.; Vulcraft Group.](#)
- B. Mechanical Fasteners
 - 1. Hilti, Inc.
 - 2. ITW Buildex (limited to use in base material of 0.0346 inches or less)
 - 3. Pneutek
 - 4. Other approved alternative
- C. Sidelap Connectors
 - 1. Elco
 - 2. Hilti, Inc.
 - 3. ITW Buildex
 - 4. Other approved alternative

2.3 MATERIALS

- A. Roof Deck (Non-Acoustic): Fabricate panels, without top-flange stiffening grooves, to comply with "SDI Specifications and Commentary for Steel Roof Deck," in SDI Publication No. 31, and with the following:
 - 1. Galvanized-Steel Sheet: ASTM A 653, Structural Steel (SS), Grade 33, G90 zinc coating.
 - 2. Deck Profile: As indicated. Field verify existing deck profiles wherever new deck is to lap with existing. Contractor is solely responsible to verify that deck profiles will nest within one another.
 - 3. Profile Depth: As indicated.
 - 4. Design Uncoated-Steel Thickness: As indicated.
 - 5. Span Condition: Triple span or more.

6. Side Laps: Overlapped (Nestable).
- B. Form Deck: Fabricate panels, without top-flange stiffening grooves, to comply with "SDI Specifications and Commentary for Non-Composite Form Deck," in SDI Publication No. 31, and with the following:
1. Galvanized-Steel Sheet: ASTM A 653, Structural Steel (SS), Grade 33, G90 zinc coating.
 2. Deck Profile: As indicated. Field verify existing deck profiles wherever new deck is to lap with existing. Contractor is solely responsible to verify that deck profiles will nest within one another.
 3. Profile Depth: As indicated.
 4. Design Uncoated-Steel Thickness: As indicated.
 5. Span Condition: Triple span or more.
- C. Side Laps: Overlapped (Nestable). Welds and Mechanical Fasteners:
1. Welds:
 - a. Material: Electric shielded arc process using minimum E60XX electrodes in accordance with AWS D1.3 procedures
 - b. Weld Quality: All welds uniform size and appearance and free of pinholes, porosity, undercutting or other defects
 - c. Weld Size: Minimum 5/8 in. effective diameter
 - d. Weld Washers: Use on steel roof deck thinner than 22 gauge
 2. Mechanical Fasteners:
 - a. Material: AISI 1070 modified
 - b. Hardness: Minimum Rockwell Hardness C 54.5
 - c. Strength: Minimum tensile strength 285 ksi; minimum shear strength 175 ksi
 - d. Design and Manufacture: Knurled shank with forged ballistic point. Manufacturing process shall ensure steel ductility and prevent development of hydrogen embrittlement.
 - e. Washers:
 - 1) For steel bar joist framing: 0.472 inch steel washers
 - 2) For structural steel framing: Minimum 0.591 inch steel washers
 - f. Corrosion Resistance:
 - 1) For steel roof decks with waterproofing membrane: 5 micron zinc electroplated in accordance with ASTM B 633 SC1 Type III
 - 2) For exposed exterior steel roof decks: Minimum AISI 304 stainless steel sealing caps with bonded neoprene washer shall be installed over each fastener
 - g. Approved Types
 - 1) For use with steel bar joist and light structural steel framing supports with top chord or flange thickness 1/8 inch to 3/8 inch:
 - a) Hilti X-HSN 24 (1/8 in. up to and including 3/8 in.)
 - b) Other approved alternative
 - 2) For use with structural steel framing supports with top flange thickness 1/4 inch or thicker:
 - a) Hilti X-ENP-19 L15 (1/4 in. or thicker)
 - b) Other approved alternative
 - 3) For use with Cold Formed Steel Framing
 - a) ITW Buildex TEKS Self Drilling Fasteners
 - b) Other approved alternative
- D. Sidelap Connectors
1. Acceptable types of sidelap connectors:
 - a. Mechanical sidelap connectors
 - 1) Drive mechanical sidelap connectors completely through adjacent lapped roof deck sheets to achieve positive engagement of adjacent sheets with a minimum of three thread penetration.
 - 2) Material: ASTM A 510 Grade 1022

- 3) Hardness: Minimum Vickers Surface Hardness of 450 HV0.3
 - 4) Design and Manufacture: Hex washer head undercut with reverse serrations; self-piercing or stitch point at center
 - 5) Approved Types
 - a) Hilti S-SLC01 M HWH Sidelap Connector
 - b) Hilti S-SLC02 M HWH Sidelap Connector
 - c) ITW Buildex TEKS Self Drilling Fasteners
 - d) Other approved alternative
- b. Button punches shall not be used unless specifically noted

2.4 TOLERANCES

- A. The minimum uncoated steel thickness as delivered to the job site shall not at any location be less than 95% of the design thickness, however lesser thicknesses shall be permitted at bends, such as corners, due to cold-forming effects.
- B. Panel length shall be no less than 1/2 inch shorter than the specified length nor greater than 1/2 inch longer than the specified length for single span. Panel length shall be no less than 1/2 inch shorter than the specified length for lapped end deck.
- C. Panel cover width shall be no less than 3/8 inch less than the specified panel width, nor more than 3/4 inch greater than the specified width.
- D. Panel camber and/or sweep shall not be greater than 1/4 inch in a 10 foot length
- E. Panel end out of square shall not exceed 1/8 inch per foot of panel width.

2.5 ACCESSORIES

- A. General: Provide manufacturer's standard accessory materials for deck that comply with requirements indicated.
- B. Flexible Closure Strips: Vulcanized, closed-cell, synthetic rubber.
- C. Miscellaneous Sheet Metal Deck Accessories: Steel sheet, minimum yield strength of 33,000 psi, not less than 0.0359-inch design uncoated thickness, of same material and finish as deck; of profile indicated or required for application.
- D. Column Closures, End Closures, Z-Closures, and Cover Plates: Steel sheet, of same material, finish, and thickness as deck unless otherwise indicated.
- E. Piercing Hanger Tabs: NOT PERMITTED
- F. Weld Washers: Uncoated steel sheet, shaped to fit deck rib, 0.056 inch thick, with factory-punched hole of 3/8-inch minimum diameter (for weld-fastening deck with an uncoated minimum steel thickness of less than 0.028 inch).
- G. Galvanizing Repair Paint: ASTM A 780.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine supporting frame and field conditions for compliance with requirements for installation tolerances and other conditions affecting performance.
- B. Confirm location and elevation of supporting steel framing with the Drawings.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Layout: Place steel roof deck sheets as shown on the Drawings ensuring bearing on supporting steel framing. Sheets shall be true and straight with horizontal deviations less than 1/4 in. in 100 feet.
- B. Marking: Mark steel roof deck at the centerline of supporting steel members to prevent weld burn through or mechanical fastener punch through. Use a chalk line or indelible marker.
- C. Test Fastenings:
 - 1. Welds: Perform project specific test welds prior to final installation per AWS D1.3. Test welds are considered examples of representative work.
 - 2. Mechanical fasteners: Gauge powder-actuated tool systems to the base material steel type, steel deck type and thickness prior to final installation. Confirm appropriate power regulation and powder-actuated cartridge type prior to final installation.

3.3 INSTALLATION, GENERAL

- A. Install deck panels and accessories according to applicable specifications and commentary in SDI Publication No. 31, manufacturer's written instructions, and requirements in this Section.
- B. Locate deck bundles to prevent overloading of supporting members.
 - 1. Deck bundles must always be placed on the steel frame near a main supporting beam at a column or wall. In no case shall the bundles be placed on unbolted frames or unattached or unbridged joists.
 - 2. The structural frame must be properly braced to receive bundles
- C. Place deck panels on supporting frame and adjust to final position with ends accurately aligned and bearing on supporting frame before being permanently fastened.
- D. Place deck panels flat and square and fasten to supporting frame without warp or deflection.
- E. Cut and neatly fit deck panels and accessories around openings and other work projecting through or adjacent to deck.
- F. Provide additional reinforcement and closure pieces at openings as required for strength, continuity of deck, and support of other work.
- G. Comply with AWS requirements and procedures for manual shielded metal arc welding, appearance and quality of welds, and methods used for correcting welding work.

- H. All OSHA, State, and Local rules for erection shall be followed.

3.4 MECHANICAL FASTENERS

- A. Fasteners shall not be installed into structural supports which are outside the acceptable limits of the manufacturers applicable test report or other documentation.
- B. Fastener edge distance shall be as required by the applicable fastener design standard or manufacturer's instructions.
- C. When the structural support thickness is less than 1/8 inch, powder actuated or pneumatically driven fasteners shall not be used unless lesser support thicknesses are permitted by applicable fastener test report or other documentation acceptable to Shell and Meyer.
- D. Screws shall have a grip range compatible with the combined thickness of the deck and supporting member.

3.5 ROOF DECK INSTALLATION

- A. Install steel roof deck and accessories in accordance with manufacturer's instructions and as shown on the Drawings.
- B. Secure steel roof deck to supporting steel framing, collectors, drag members, and perimeter members with arc spot welds, fillet welds or mechanical fasteners as indicated. Install welds or mechanical fasteners at the spacing and pattern as shown on the Drawings. Anchorage shall provide temporary lateral stability to the top flange of the supporting structural members.
- C. Deck shall be anchored to resist the required net uplift forces as noted on the Construction Drawings, but not less than the following:
 - 1. 45 pounds per square foot for eave overhang.
 - 2. 30 pounds per square foot for all other roof areas.
- D. Secure steel roof deck sidelap connectors at the spacing and pattern as shown on the Drawings.
- E. Unless otherwise noted on the Construction Drawings the following minimum deck attachments shall apply:
 - 1. Deck to Supports: Edge ribs of panels (the bottom flange of the last rib of a deck panel) shall be fastened to each point of support. Additional fasteners between edge ribs shall be spaced an average of 12 inches apart but not more than 18 inches, unless otherwise noted on the Construction Drawings.
 - 2. Connecting Sidelaps: Side laps shall be fastened at intervals not to exceed 36 inches on center, using one of the following methods:
 - a. Screws with a minimum diameter of 0.190 inches (#10 diameter)
 - 3. Perimeter Supports: Perimeter edges of deck units between span supports shall be fastened at intervals not to exceed 12 inches on center, using one of the following methods:
 - a. Screws with a minimum diameter of 0.210 inches (#12 diameter)
 - b. Arc spot welds with a minimum 5/8 inch minimum visible diameter.
 - c. Powder actuated or pneumatically driven fasteners.
- F. Cantilevers:
 - 1. Side laps shall be attached at the end of the cantilever and at a maximum spacing of 12 inches on center from the cantilever end at each support.

2. Each corrugation shall be fastened at both the perimeter support and the first interior support.
3. The deck shall be completely attached to the supports and at the side laps before any load is applied to the cantilever.

G. Fastener edge distance shall be as required by the applicable fastener design standard.

H. End Bearing: Install deck ends over supporting frame with a minimum end bearing of 1-1/2 inches, with end joints as follows:

1. End Joints: Lapped 2 inches minimum.

I. Infill of Existing Deck Openings:

1. Infill of existing deck openings shall be accomplished with lengths of deck sheet able to span between supports in a single piece.
2. Extend infill deck no less than 3" past the centerline of support members and lap with existing roof deck.

J. Deck bearing surfaces shall be permitted to deviate from parallel a maximum of 1:24, but not to exceed 1/16 inch.

1. Where deck bearing exceeds limits above, deck supplier shall provide continuous cold formed steel bent plate to match gauge of deck. Anchor to support with 1 1/2 inch fillet welds or mechanical fasteners at spacing to match support fasteners.

K. Miscellaneous Roof-Deck Accessories: Supply and install ridge and valley plates, finish strips, end closures, and reinforcing channels according to deck manufacturer's written instructions. Weld or mechanically fasten to substrate to provide a complete deck installation.

1. Minimum thickness of accessories shall match deck thickness, unless otherwise noted.
2. Weld cover plates at changes in direction of roof-deck panels unless otherwise indicated.
3. Accessories shall be anchored to supporting members by arc spot welds or self drilling screws at 12 inches maximum intervals or as shown on the Construction Drawings.

3.6 ACCESSORY ATTACHMENT

A. Structural accessories shall be attached to supporting structure or deck as required for transfer of forces, but not to exceed 12 inches on center.

B. Non-structural accessories shall be attached to supporting structure or deck as required for serviceability, but not to exceed 12 inches on center.

3.7 DECK DAMAGE AND PENETRATIONS

A. Round openings not shown on the erection drawings, such as those required for stacks, conduits, plumbing, vents, etc. shall be cut (and reinforced, if necessary) by the trades requiring the openings.

1. A single opening of up to 6 inches in diameter may be placed in 1-1/2 inch steel roof deck.
 - a. Spacing Perpendicular to Deck Flutes: Adjacent holes perpendicular to deck flutes must be placed at least 3 feet apart, or an angle frame will be required.
 - b. Spacing Parallel to Deck Flutes: Adjacent holes parallel to deck flutes must be placed at least 12 inches apart as long as only one deck flute per sheet is being removed, or an angle frame will be required.

2. Reinforce holes or dents in wide rib deck with a 20 inch square plate and attach to deck ribs with welds or screws at 8 inches on center maximum around the perimeter of the plate. Thickness of the plate shall be as follows:
 - a. Up to 6 inches in diameter: No reinforcing required
 - b. 6 inches to 8 inches in diameter: 0.045 inch minimum plate thickness
 - c. 8 inches to 12 inches in diameter: 0.057 inch minimum plate thickness
 - d. Over 12 inches: Frame opening
3. Spacing of reinforced openings /dents shall be 36 inches on center minimum each way.
4. Fasteners used around openings, both framed and reinforced, shall be the same type used to attach the deck to the frame. Spacing shall not exceed 8 inches on center around the opening.
5. Openings or cut outs for Roof Sump Pans and Sump Plates shall comply with above reinforcing requirements.

B. Trades that subsequently cut unscheduled openings through the deck shall be responsible for reinforcing these openings based on an approved and sealed engineered design and submitted to Shell and Meyer Associates, Inc. for approval.

1. Alternatively, the contractor can independently retain Shell + Meyer to provide additional design services required to determine the reinforcement requirements around the proposed opening.

3.8 FIELD QUALITY CONTROL

A. Testing Agency: Owner will engage a qualified testing agency to perform tests and inspections.

B. Special Inspection of Deck Placement:

1. Confirm minimum end bearing.
2. Confirm bearing surface tolerances comply with SDI as noted in Executions article above

C. Special Inspection of Deck Welds:

1. Examination and qualification of puddle and fillet welds shall be in accordance with AWS D1.3 criteria.
2. Inspections Prior to Deck Placement
 - a. Verify compliance of materials (deck and all deck accessories) with Construction Documents, including profiles, material properties, and base metal thickness
 - b. Document acceptance or rejection of deck and deck accessories
3. Inspections After Deck Placement
 - a. Verify compliance of deck and all deck accessories installation with Construction Documents
 - b. Document acceptance or rejection of installation of deck and deck accessories
4. Inspection Tasks Prior to Welding
 - a. Welding Procedure Specifications (WPS) are available
 - b. Manufacturer certifications for welding consumables are available
 - c. Material identification (type and grade)
 - d. Check welding equipment
 - e. Ensure steel roof deck is clamped to the supporting steel framing.
5. Inspection Tasks During Welding
 - a. Use of qualified welders
 - b. Control and handling of consumables
 - c. Environmental conditions (wind speed, moisture, temperature)
 - d. WPS followed
 - e. Weld metal shall penetrate all layers of deck material at end laps and shall have good fusion to the supporting members.
6. Inspection Tasks After Welding
 - a. Verify size and location of welds, including support, sidelap, and perimeter welds

- b. Welds meet visual acceptance criteria
 - c. Verify repair activities
 - d. Document acceptance or rejection of welds
- D. Special Inspection of Mechanical Fasteners:
- 1. Inspection Tasks Prior to Mechanical Fastening
 - a. Manufacturer's Published Installation Instructions (MPII) available for mechanical fasteners
 - b. Proper tools available for fastener installation
 - c. Proper storage for mechanical fasteners
 - d. Ensure steel roof deck is clamped to the supporting steel framing.
 - 2. Inspection Tasks During Mechanical Fastening
 - a. Fasteners are positioned as required
 - b. Examination of washer condition
 - c. Fastener's are installed in accordance with MPII
 - 3. Inspection Tasks After Mechanical Fastening
 - a. Check spacing, type, and installation of *support* fasteners
 - b. Check spacing, type, and installation of *sidelap* fasteners
 - c. Check spacing, type, and installation of *perimeter* fasteners
 - d. Verify repair activities
 - e. Document acceptance or rejection of mechanical fasteners
- E. Testing agency will report inspection results promptly and in writing to Contractor and Architect.
- F. Remove and replace work that does not comply with specified requirements.
- G. Additional inspecting, at Contractor's expense, will be performed to determine compliance of corrected work with specified requirements.
- 3.9 PROTECTION
- A. Steel deck shall be protected against contact with materials that cause, or can be shown to cause, corrosion or other deterioration of the deck and accessories.
 - B. Pressure treated wood shall not be placed in direct contact with the steel deck without installing a protective barrier between the two.
 - C. Provide final protection and maintain conditions to ensure that steel deck is without damage or deterioration at time of Substantial Completion.
 - D. Deck areas subject to heavy or repeated traffic, concentrated loads, impact loads, wheel loads, or other like loading, shall be adequately protected by planking or other means to avoid overloading or damage.
 - E. Do not exceed construction load carrying capacity of steel roof deck sheets for type and span defined in SDI Construction Load Tables.
 - F. Do not use deck units as a working platform or storage area until units are permanently attached in position.

3.10 REPAIR / RESTORATION

- A. Before placement of roof insulation and roof covering, the deck shall be inspected for tears, dents or other damage that may prevent the deck from acting as a structural roof base.
 - 1. The need for repair of the damaged deck shall be determined by the Structural Engineer of Record.
- B. Galvanizing Repairs: Prepare and repair damaged galvanized coatings on both surfaces of deck with galvanized repair paint according to ASTM A 780 and manufacturer's written instructions.
- C. Welds: Repair all portions of the steel roof deck coating damaged due to weld heat with compatible paint type or zinc rich compound. Repair all burn through marks in accordance with SDI Deck Damage and Penetrations.
- D. Repair Painting: Wire brush and clean rust spots, welds, and abraded areas on both surfaces of prime-painted deck immediately after installation, and apply repair paint.
 - 1. Apply repair paint, of same color as adjacent shop-primed deck, to bottom surfaces of deck exposed to view.
- E. Mechanical Fasteners: Replace or supplement under-driven and over driven fasteners with adjacent, properly installed fasteners.

END OF SECTION 053123

SECTION 054000 - COLD-FORMED STEEL FRAMING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Exterior Load-bearing wall framing.
2. Interior Load bearing wall framing.
3. Exterior non-load-bearing wall framing.
4. Floor joist framing.
5. Roof rafter framing.
6. Ceiling joist framing.
7. Shear wall framing
8. Diagonal Strap Bracing
9. Proprietary Diagonal Strap Bracing System

B. Related Requirements:

1. Section 092116.23 "Gypsum Board Shaft Wall Assemblies" for interior non-load-bearing, metal-stud-framed, shaft-wall assemblies.
2. Section 092216 "Non-Structural Metal Framing" for interior non-load-bearing, metal-stud framing and ceiling-suspension assemblies.

1.2 REFERENCES

A. American Iron and Steel Institute (AISI):

1. COSP Specification for the Design of Cold-Formed Steel Structural Members, Code of Standard Practice.
2. AISI S100 North American Specifications for the Design of Cold Formed Steel Structural Members.
3. AISI S200 North American Standard for Cold-Formed Steel Framing - General Provisions.
4. AISI S201 North American Standard for Cold-Formed Steel Framing - Product Data.
5. AISI S211 North American Standard for Cold-Formed Steel Framing - Wall Stud Design.
6. AISI S212 North American Standard for Cold-Formed Steel Framing – Header Design.
7. AISI S213 North American Standard for Cold-Formed Steel Framing - Lateral Design.

B. American Welding Society (AWS):

1. AWS D.1.3 Structural Welding Code - Sheet Steel.

C. International Code Council

1. AC261 Connectors Used with Cold-formed Steel Structural Members

D. Military Specifications:

1. DOD-P-21035 Specification Galvanizing Repair Coating.

E. The Society for Protective Coatings (SSPC):

1. SSPC-Paint 20 - Zinc Rich Primers – Type I Inorganic And Type II Organic.

1.3 ACTION SUBMITTALS

- A. Product Data: Submit specified information as follows:
 - 1. Manufacturer's product data, including manufacturer's technical data sheet.
 - 2. Catalog pages illustrating products to be incorporated into project and clearly indicating which product is to be incorporated.
 - a. Do NOT submit entire catalogs
- B. Shop Drawings:
 - 1. Include plans, sections, elevations, layout, spacings, sizes, thicknesses, and types of cold-formed steel framing; fabrication; and fastening and anchorage details, including mechanical fasteners.
 - a. Layout all bearing walls and non-load bearing walls
 - 2. Indicate reinforcing channels, opening framing, supplemental framing, strapping, bracing, bridging, splices, accessories, connection details, and attachment to adjoining work.
 - a. Layout and coordinate all bracing locations
 - 3. Indicate connection details with screw types and locations, weld lengths and locations, fastening devices, and other fastener requirements.
- C. Delegated Design Submittals: Submit structural calculations as follows:
 - 1. Structural calculations prepared by manufacturer for approval. Submittal shall be sealed by a professional engineer registered in the State of Ohio.
 - 2. Description of design criteria.
 - 3. Engineering analysis depicting stress and deflection (stiffness) requirements for each framing application.
 - 4. Selection of framing components, accessories and welded connection requirements.
 - 5. Verification of attachments to structure and adjacent framing components.

1.4 INFORMATIONAL SUBMITTALS

- A. The following documents shall be available in electronic or printed form for review by the EOR prior to fabrication or erection, as applicable, unless otherwise required in the contract documents to be submitted:
- B. Welding certificates.
- C. Product Test Reports: For each listed product, for tests performed by a qualified testing agency.
 - 1. Power-actuated anchors.
 - 2. Mechanical fasteners.
 - 3. Vertical deflection clips.
 - 4. Horizontal drift deflection clips
 - 5. Miscellaneous structural clips and accessories.
- D. Research/Evaluation Reports: For cold formed steel framing.
 - 1. Metal stud manufacturer to have a 3rd party evaluation report for its products that are reviewed to the local building code or its model code and AISI S100.

1.5 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Member in good standing of the Steel Framing Industry Association (SFIA).

1. Products to be certified under an independent third party inspection program administered by an agency accredited by IAS to ICC-ES AC98 IAS Accreditation Criteria for Inspection Agencies.
 - B. Steel framing manufacturer shall provide a qualified representative for periodic on-site review to insure fabrication and installation complies with manufacturer's recommendations.
 - C. Engineering Responsibility: Preparation of Shop Drawings, design calculations, and other structural data by a qualified professional engineer.
 - D. Professional Engineer Qualifications: A professional engineer who is legally qualified to practice in jurisdiction where project is located and who is experienced in providing engineering services of the kind indicated. Engineering services are defined as those performed for installations of cold-formed metal framing that are similar to those indicated for this project in material, design, and extent.
 - E. Installer: Acceptable to the manufacturer, experienced in performing work of this section and has specialized in installation of work similar to that required for this project.
 - F. Testing Agency Qualifications: An independent testing agency, acceptable to authorities having jurisdiction, qualified according to ASTM E 329 for testing indicated.
 - G. Product Tests: Mill certificates or data from a qualified independent testing agency, or in-house testing with calibrated test equipment indicating steel sheet complies with requirements, including base-metal thickness, yield strength, tensile strength, total elongation, chemical requirements, and metallic-coating thickness.
 - H. Welding Qualifications:
 1. Certified by the AWS within the previous 12 months
 2. Qualify procedures and personnel according to the following:
 - a. AWS D1.1/D1.1M, "Structural Welding Code - Steel."
 - b. AWS D1.3/D1.3M, "Structural Welding Code - Sheet Steel."
 - I. AISI Specifications and Standards: Comply with:
 1. AISI S100 "North American Specification for the Design of Cold-Formed Steel Structural Members".
 2. AISI S200 "North American Standard for Cold-Formed Steel Framing – General Provisions".
 3. AISI S201 "North American Standard for Cold-Formed Steel Framing – Product Standard".
 4. AISI S211 "North American Standard for Cold-Formed Steel Framing – Wall Stud Design".
 5. AISI S212 "North American Standard for Cold-Formed Steel Framing – Header Design".
 6. AISI S213 "North American Standard for Cold-Formed Steel Framing – Lateral Design".
 7. AISI "Code of Standard Practice for Cold-Formed Steel Structural Framing".
- 1.6 COORDINATION
- A. Cold Formed Steel contractor to install steel bearing plates, strap brace channel anchors, and stud clip angles to foundation unless specifically noted by the General Contractor or Construction Manager.
- 1.7 DELIVERY, STORAGE, AND HANDLING
- A. Protect and store cold-formed steel framing from corrosion, moisture staining, deformation, and other damage during delivery, storage, and handling as required in AISI's "Code of Standard Practice".

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide cold-formed steel framing and connectors by one of the following:, or comparable products from members of the SFIA:
1. ClarkDietrich Building Systems www.clarkdietrich.com 1-800-543-7140
 2. Marino\WARE Framing www.marinoware.com 1-866-636-6002
 3. The Steel Network, Inc. www.steelnetwork.com 1-888-474-4876
 4. Simpson Strong-Tie www.strongtie.com 1-800-999-5099
- B. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings
- C. Single Source Responsibility: Provide components and materials specified in this section from a single manufacturer where proprietary systems are used.

2.2 PERFORMANCE REQUIREMENTS

- A. Delegated Design: Engage a qualified professional engineer, as defined in Section 014000 "Quality Requirements," to design cold-formed steel framing.
- B. Structural Performance: Provide cold-formed steel framing capable of withstanding design loads within limits and under conditions indicated.
1. Design Loads: As indicated on the Construction Documents and per the following minimum design loads.
 - a. Dead Loads: Weights of materials and construction
 - b. Live Loads: Per Ohio Building Code Table 1607.1
 - c. Snow Loads: 24 PSF base snow
 - d. Wind Loads:
 - 1) Main Wind Force Resisting Systems (MWFRS)
 - 2) Components and Cladding
 2. Maximum allowable deflection
 - a. Gypsum Board: L/360 of span under total design loads.
 - b. Exterior Insulation Finish System: L/360 of span under total design loads.
 - c. Plaster or Stucco: L/360 of span under total design loads.
 - d. Brick Veneer: L/600 of span under total design loads.
 3. Deflection Limits: Design framing systems to withstand design loads without deflections greater than the following:
 - a. ALL walls with brick veneer:
 - 1) Horizontal Live Load deflection of 1/600 of the wall height.
 - 2) Horizontal Total Load deflection of 1/360 of the wall height.
 - b. Exterior Wall Framing – No Veneer:
 - 1) Horizontal Live Load deflection of 1/360 of the wall height.
 - 2) Horizontal Total Load deflection of 1/240 of the wall height.
 - c. Interior Load-Bearing Wall Framing:
 - 1) Horizontal Live Load deflection of 1/240 of the wall height under a horizontal load of 5 lbf/sq. ft..
 - d. Roof Joist Framing:
 - 1) Vertical Live Load deflection of 1/240 of the span.

- 2) Vertical Total Load deflection of 1/180 of the span.
- e. Ceiling Joist Framing:
 - 1) Vertical Live Load deflection of 1/240 of the span.
 - 2) Vertical Total Load deflection of 1/180 of the span.
4. Design framing systems to provide for movement of framing members located outside the insulated building envelope without damage or overstressing, sheathing failure, connection failure, undue strain on fasteners and anchors, or other detrimental effects when subject to a maximum ambient temperature change of 120 deg F.
5. Design exterior non-load-bearing wall framing to accommodate horizontal deflection without regard for contribution of sheathing materials.

2.3 COLD-FORMED STEEL FRAMING, GENERAL

- A. Compatibility:
 1. Ensure components and materials are compatible with specified accessories and adjacent materials.
- B. Steel Sheet: ASTM A 1003, Structural Grade, Type H, metallic coated, of grade and coating weight as follows:
 1. Grade:
 - a. ST33H for thicknesses less than 0.0538 inch (16 Ga.).
 - b. ST50H for thicknesses greater than or equal to 0.0538 inch (16 Ga.).
 2. Coating:
 - a. G90 or equivalent for studs with a brick veneer.
 - b. G60, A60, AZ50, or GF30 for all other studs, unless noted otherwise
- C. Steel Sheet for Vertical Deflection and Drift Clips: ASTM A 653, structural steel, zinc coated, of grade and coating as follows:
 1. Grade: 50, Class 1.
 2. Coating: G90.

2.4 WALL FRAMING

- A. Steel Studs: C-shaped steel studs, of web depths indicated, punched, with stiffened flanges, and as follows:
 1. Type: Manufacturer's Standard C-Shape.
 2. Minimum Flange Width: 1-5/8 inches.
- B. Opening Framing:
 1. Allow for alternative valued engineered opening framing systems (RedHeader RO System) manufactured by ClarkDietrich Building Systems or approved equal.
 2. Minimum Material Thickness: As required by design.
 3. Minimum Flange Width: As required by design.
- C. Deflection Track and Firestop Track: Steel sheet top runner manufactured to prevent cracking of finishes applied to interior partition framing resulting from deflection of structure above; in thicknesses not less than indicated for studs and in width to accommodate depth of studs.
 1. Basis-of-Design Product: ClarkDietrich Building Systems; BlazeFrame Deflection Track.

- D. Wall Bridging:
1. Channel Bridging Inside Wall: 1-1/2 inch web, 3/4-inch flanges, [0.0342 inch] uncoated thickness and G-90 hot-dipped galvanized coating according to ASTM A 123/A 123M.
 - a. Basis-of-Design Product: The Steel Network, Inc. BridgeBar® BB150.
 2. Channel Bridging Inside Wall: 1-1/2 inches tab at one end, 1-1/2 inches slot at other end, 16 inches in length.
 - a. Basis-of-Design Product: The Steel Network, Inc. BuckleBridge™.
- E. Bridging Clip: The Steel Network, Inc. [BridgeClip® with 3-5/8-inch stud depth] [BridgeClip® BC600 with 6-inch stud depth] [BridgeClip® BC800 with 8-inch stud depth]. ASTM A 653/A 653M, structural steel, zinc coated, of grade and coating as follows:
1. Grade: 50 (340), Class 1 or 2.
 2. Coating: G90 (Z275).
 3. Flat Strap. Width and thickness as required by structural design calculations.
 4. Solid Bridging: Channel-shaped bridging with lipped flanges and integral formed clips; 33 mils minimum thickness, size as required by structural design calculations.
- F. Drift Clips: Manufacturer's standard bypass or head clips, capable of isolating wall stud from upward and downward vertical displacement and lateral drift of primary structure. Mechanical attachment to structure and screw attachment to stud web using step-bushings to permit frictionless vertical movement; 68 mils minimum thickness, size as required by structural design calculations.
1. Basis-of-Design Product: The Steel Network, Inc. DriftClip® including step bushings.
 - a. Exterior Head of Wall: The Steel Network, Inc. DriftClip®DSL.
 - b. By-pass Structural Pour Stop at Floor Slab: The Steel Network, Inc. DriftClip® DSLB.
 - c. By-pass Structure: The Steel Network, Inc. DriftClip® DSLS.

2.5 ROOF-RAFTER FRAMING

- A. Steel Rafters: C-shaped steel sections, of web depths indicated, with stiffened flanges, and as follows:
1. Type: Manufacturer's Standard C-Shape.
 2. Minimum Flange Width: 1-5/8 inches.

2.6 CEILING JOIST FRAMING

- A. Steel Ceiling Joists: C-shaped steel sections, of web depths indicated, with stiffened flanges, and as follows:
1. Type: Manufacturer's Standard C-Shape.
 2. Minimum Flange Width: 1-5/8 inches.

2.7 FRAMING ACCESSORIES

- A. Fabricate steel-framing accessories from steel sheet, ASTM A 1003, Structural Grade, Type H, metallic coated, of same grade and coating weight used for framing members.
- B. Provide accessories of manufacturer's standard thickness and configuration, unless otherwise indicated, as follows:
1. Supplementary framing.
 2. Bracing, bridging, and solid blocking.
 - a. Basis-of-Design Product: ClarkDietrich Building Systems; Spazzer 5400 Bridging Bar (SPZS), Spazzer Bar Guard (SPBG).

3. Web stiffeners.
 - a. Basis-of-Design Product: ClarkDietrich Building Systems; QTWS.
 - b. Marino/WARE (JS)\
4. Solid Blocking
 - a. Marino/WARE (JB)
5. Anchor clips.
6. End clips.
7. Foundation clips.
 - a. The Steel Network, Inc. StiffClip® CL
8. Gusset plates.
9. Stud kickers and knee braces.
10. Joist hangers – As indicated on Drawings
11. End closures.
12. Hole reinforcing plates.
13. Backer plates.

2.8 ANCHORS, CLIPS, AND FASTENERS

- A. Steel Shapes and Clips: ASTM A 36, zinc coated by hot-dip process according to ASTM A 123.
- B. Cold-Formed Steel Connections: ASTM 653, zinc coated by hot-dip process according to ASTM A123.
- C. Anchor Bolts: ASTM F 1554, Grade 36, threaded carbon-steel hex-headed bolts and carbon-steel nuts; and flat, hardened-steel washers.
- D. Power-Actuated Anchors: Fastener system of type suitable for application indicated, fabricated from corrosion-resistant materials, with capability to sustain, without failure, a load equal to 8 times design load, as determined by testing per ASTM E 1190 conducted by a qualified testing agency.
 1. #12-14 Self Drilling Screw
 2. Simpson Strong Tie PDPT powder actuated pins
 - a. 0.300 inch head and 0.145 inch shank diameter
- E. Simpson SCB, SCW, and SSB connectors shall be installed with the #14 shouldered screws that are provided with the connectors.
- F. Hold-downs
 1. Simpson Strong Tie or approved equal – Size as indicated on drawings or as required by calculations.
- G. Mechanical Fasteners: ASTM C 1513, corrosion-resistant-coated, self-drilling, self-tapping, steel drill screws.
 1. Head Type: Low-profile head beneath sheathing, manufacturer's standard elsewhere.
- H. Welding Electrodes: Comply with AWS standards.

2.9 MISCELLANEOUS MATERIALS

- A. Galvanizing Repair Paint: SSPC-Paint 20 or DOD-P-21035.
- B. Nonmetallic, Nonshrink Grout: Premixed, nonmetallic, noncorrosive, nonstaining grout containing selected silica sands, portland cement, shrinkage-compensating agents, and plasticizing and water-reducing agents, complying with ASTM C 1107, with fluid consistency and 30-minute working time.

- C. Shims: Load bearing, high-density multimonomer plastic, nonleaching.
- D. Sealer Gaskets: Closed-cell neoprene foam, 1/4 inch thick, selected from manufacturer's standard widths to match width of bottom track or rim track members.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine supporting substrates and abutting structural framing for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.
- C. Verify location of cast-in-place anchors if required for stud holdowns.
- D. Install grout between the underside of load-bearing wall bottom track and the top of foundation wall or slab at locations with a gap larger than 1/4 inch to ensure a uniform bearing surface on supporting concrete or masonry construction.
- E. Install sealer gaskets at the underside of wall bottom track or rim track and at the top of foundation wall or slab at stud or joist locations.

3.2 INSTALLATION, GENERAL

- A. Install cold-formed framing in accordance with ASTM C1007 and AISI S200 "North American Standard for Cold-Formed Steel Framing - General Provisions".
- B. Cold-formed steel framing may be shop or field fabricated for installation, or it may be field assembled.
- C. Install cold-formed steel framing according to AISI's "Standard for Cold-Formed Steel Framing - General Provisions" and to manufacturer's written instructions unless more stringent requirements are indicated.
- D. Install cold-formed steel framing and accessories plumb, square, and true to line, and with connections securely fastened.
 - 1. Cut framing members by sawing or shearing; do not torch cut.
 - 2. All framing components shall be cut squarely for attachment to perpendicular members, or as required for an angular fit against abutting members.
 - 3. Members shall be held positively in place until properly fastened
- E. Axially loaded studs shall be installed in a manner, which will assure that ends of the studs are positioned against the inside track web, prior to stud and track attachment
- F. Fasten cold-formed steel framing members by welding, screw fastening, clinch fastening, or riveting. Wire tying of framing members is not permitted.
 - 1. Comply with AWS D1.3 requirements and procedures for welding, appearance and quality of welds, and methods used in correcting welding work.
 - a. Minimum Steel Thickness for Welded Connections: 0.0428 inch.
 - 2. Locate mechanical fasteners and install according to Shop Drawings, and complying with requirements for spacing, edge distances, and screw penetration.

- a. Field Fastening: Minimum of 2 self-tapping metal screws per connection, unless otherwise indicated.
 - G. Install framing members in one-piece lengths unless splice connections are indicated for track or tension members.
 - H. Install temporary bracing and supports to secure framing and support loads comparable in intensity to those for which structure was designed. Maintain braces and supports in place, undisturbed, until entire integrated supporting structure has been completed and permanent connections to framing are secured.
 - I. Do not bridge building expansion and control joints with cold-formed steel framing. Independently frame both sides of joints.
 - J. Install insulation, specified in Section 072100 "Thermal Insulation," in built-up exterior framing members, such as headers, sills, boxed joists, and multiple studs at openings, that are inaccessible on completion of framing work.
 - K. Fasten hole reinforcing plate over web penetrations that exceed size of manufacturer's approved or standard punched openings.
 - L. No notching or coping of studs is allowed.
 - M. Erection Tolerances: Install cold-formed steel framing level, plumb, and true to line to a maximum allowable tolerance variation of 1/8 inch in 10 feet and as follows:
 - 1. Space individual framing members no more than plus or minus 1/8 inch from plan location. Cumulative error shall not exceed minimum fastening requirements of sheathing or other finishing materials.
 - N. Construct all bearing walls, including strap bracing, prior to installing any roof or floor framing.
- 3.3 EXTERIOR AND LOAD-BEARING WALL INSTALLATION
- A. Install continuous top and bottom tracks sized to match stud widths. Align tracks accurately and securely anchor at corners and ends.
 - B. Butt all track joints. Securely anchor abutting pieces of track to a common structural element, or butt-weld or splice together.
 - C. Anchor runner track securely to the supporting structure as shown on erection drawings. Install concrete anchors only after full compressive strength has been achieved. Provide a sill sealer or gasket barrier between all concrete and steel connections.
 - D. Squarely seat studs against top and bottom tracks with gap not exceeding 1/8 inch between the end of wall framing member and the web of track.
 - 1. Pressure shall be applied to nest the bearing stud into the tracks until the tolerance listed above is achieved. Failure to do so may result in future serviceability problems.
 - 2. Fasten both flanges of studs to top and bottom tracks. Space studs as indicated.
 - E. Set studs plumb, except as needed for diagonal bracing or required for nonplumb walls or warped surfaces and similar configurations.

- F. Align studs vertically where floor framing interrupts wall-framing continuity. Where studs cannot be aligned, continuously reinforce track to transfer loads.
- G. Align floor and roof framing over studs according to AISI S200, Section C1. Where framing cannot be aligned, continuously reinforce track to transfer loads.
- H. Anchor studs abutting structural columns or walls, including masonry walls, to supporting structure as indicated.
- I. Install jack studs or cripples below window sills, above window and door heads, at freestanding stair rails and elsewhere to furnish support. Securely attach to supporting members.
- J. Construct corners using a minimum of 3 studs. Use double studs, one of which is full length unless indicated otherwise, at wall openings, doors and window jambs.
- K. Install headers over wall openings wider than stud spacing. Locate headers above openings as indicated. Fabricate headers of compound shapes indicated or required to transfer load to supporting studs, complete with clip-angle connectors, web stiffeners, or gusset plates.
 - 1. Frame wall openings with not less than a double stud at each jamb of frame as indicated on Shop Drawings. Fasten jamb members together to uniformly distribute loads.
 - a. A single proprietary jamb member designed specifically for the purpose of supporting the header may be used in lieu of multiple members.
 - 2. Install runner tracks and jack studs above and below wall openings. Anchor tracks to jamb studs with clip angles or by welding, and space jack studs same as full-height wall studs.
- L. Install supplementary framing, blocking, and bracing in stud framing indicated to support fixtures, equipment, services, casework, heavy trim, furnishings, and similar work requiring attachment to framing.
 - 1. If type of supplementary support is not indicated, comply with stud manufacturer's written recommendations and industry standards in each case, considering weight or load resulting from item supported.
- M. Install horizontal bridging in stud system, spaced in rows as indicated on Shop Drawings but not more than 48 inches apart for wind loaded walls and 3 feet 4 inches apart for axial loaded walls. Fasten at each stud intersection.
 - 1. Bridging: Steel channel, welded or mechanically fastened to webs of punched studs with a minimum of two screws into each flange of the clip angle for framing members up to 6 inches deep.
 - 2. Bridging: Combination of flat, taut, steel sheet straps of width and thickness indicated and stud-track solid blocking of width and thickness to match studs. Fasten flat straps to stud flanges and secure solid blocking to stud webs or flanges.
 - 3. Bridging: Proprietary wall bridging installed according to manufacturer's written instructions.
- N. Install steel sheet diagonal bracing straps to both stud flanges (i.e. each face), terminate at and fasten to reinforced top and bottom tracks.
- O. Fasten clip-angle connectors to multiple studs at ends of bracing and anchor to structure as shown in shop drawings.
- P. Install miscellaneous framing and connections, including supplementary framing, web stiffeners, clip angles, continuous angles, anchors, and fasteners, to provide a complete and stable wall-framing system.

3.4 EXTERIOR NON-LOAD-BEARING CURTAIN WALL INSTALLATION

- A. Install continuous tracks sized to match stud width. Align tracks accurately and securely anchor to supporting structure as indicated.
- B. Fasten both flanges of studs to **top and** bottom track unless otherwise indicated. Space studs as follows:
- C. Set studs plumb, except as needed for diagonal bracing or required for nonplumb walls or warped surfaces and similar requirements.
- D. Isolate non-load-bearing steel framing from building structure to prevent transfer of vertical loads while providing lateral support.
 - 1. Mechanically fasten vertical deflection clips to studs and anchor to building structure.
- E. Install horizontal bridging in wall studs, spaced in rows indicated on Shop Drawings but not more than 48 inches apart. Fasten at each stud intersection.
 - 1. Top Bridging for Single Deflection Track: Install row of horizontal bridging [Spazzer Proprietary Bridging Bar (SPZS)] within 12 inches of single deflection track. [Bridging is not required in top row when using proprietary slotted deflection track (BlazeFrame DSL) (MaxTrak) (SLP-TRK).] Install a combination of flat, taut, steel sheet straps of width and thickness indicated and stud or stud-track solid blocking of width and thickness matching studs. Fasten flat straps to stud flanges and secure solid blocking to stud webs or flanges.
 - a. Install solid blocking at **96-inch** centers.
 - 2. Bridging: Cold-formed steel channel, welded or mechanically fastened to webs of punched studs.
 - 3. Bridging: Combination of flat, taut, steel sheet straps of width and thickness indicated and stud-track solid blocking of width and thickness to match studs. Fasten flat straps to stud flanges and secure solid blocking to stud webs or flanges.
 - 4. Bridging: Proprietary bridging bars installed according to manufacturer's written instructions.
- F. Install miscellaneous framing and connections, including stud kickers, web stiffeners, clip angles, continuous angles, anchors, and fasteners, to provide a complete and stable wall-framing system.

3.5 JOIST INSTALLATION

- A. Install in accordance with AISI's S210 "North American Standard for Cold-Formed Steel Framing - Floor and Roof System Design".
- B. Install perimeter joist track sized to match joists. Align and securely anchor or fasten track to supporting structure at corners, ends, and spacings indicated on Shop Drawings.
- C. Locate joist end bearing directly over load bearing studs or provide load-distributing member to top of stud track.
- D. Install joists bearing on supporting frame, level, straight, and plumb; adjust to final position, brace, and reinforce. Fasten joists to both flanges of joist track.
 - 1. Install joists over supporting frame with a minimum end bearing of 1-1/2 inches.
 - 2. Reinforce ends and bearing points of joists with web stiffeners, end clips, joist hangers, steel clip angles, or steel-stud sections as indicated on Shop Drawings.

- E. Provide end blocking where joist ends are not otherwise restrained from rotation.
- F. Space joists not more than 2 inches from abutting walls, and as follows:
 - 1. Joist Spacing: As indicated.
- G. Frame openings with built-up joist headers consisting of joist and joist track, nesting joists or another combination of connected joists if indicated.
- H. Install joist reinforcement at interior supports with single, short length of joist section located directly over interior support, with lapped joists of equal length to joist reinforcement, or as indicated on Shop Drawings.
 - 1. Install web stiffeners to transfer axial loads of walls above.
- I. Install bridging at intervals indicated on Shop Drawings or at the minimum recommended spacing per the Manufacturer's published installation instructions. Fasten bridging at each joist intersection as follows:
 - 1. Bridging: Combination of flat, taut, steel sheet straps of width and thickness indicated and joist-track solid blocking of width and thickness indicated. Fasten flat straps to bottom flange of joists and secure solid blocking to joist webs.
 - 2. Minimum size of flat strap: 1-1/2 by 0.0329 inch.
- J. Secure joists to load-bearing interior walls to prevent lateral movement of bottom flange.
- K. All field holes must be reinforced. No notching or coping of joists or rafters is allowed.
- L. Install miscellaneous joist framing and connections, including web stiffeners, closure pieces, clip angles, continuous angles, hold-down angles, anchors, and fasteners, to provide a complete and stable joist-framing assembly.

3.6 FIELD QUALITY CONTROL

- A. Testing: Owner will engage a qualified independent testing and inspecting agency to perform field tests and inspections and prepare test reports.
- B. Field and shop welds will be subject to testing and inspecting.
 - 1. Visually inspect 100 percent of welds for specified length, size, and continuity per AWS D1.3 for metal less than 1/8 inch thickness for Work designed as a structural element.
- C. Testing agency will report test results promptly and in writing to Contractor and Architect.
- D. Remove and replace work where test results indicate that it does not comply with specified requirements.
- E. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.

3.7 REPAIRS AND PROTECTION

- A. Galvanizing Repairs: Prepare and repair damaged galvanized coatings on fabricated and installed cold-formed steel framing with galvanized repair paint according to ASTM A 780 and manufacturer's written instructions.

- B. Provide final protection and maintain conditions, in a manner acceptable to manufacturer and Installer, to ensure that cold-formed steel framing is without damage or deterioration at time of Substantial Completion.

END OF SECTION 054000

SECTION 055000 - METAL FABRICATIONS

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes the following:
 - 1. Metal ladders.
 - 2. Loose steel lintels.
 - 3. Steel framing and decking at roof opening / infill areas.

1.2 PERFORMANCE REQUIREMENTS

- A. Structural Performance of Ladders: Provide ladders capable of withstanding the effects of loads and stresses within limits and under conditions specified in ANSI A14.3.

1.3 SUBMITTALS

- A. Shop Drawings: Show fabrication and installation details for metal fabrications.
- B. Welding certificates.

1.4 QUALITY ASSURANCE

- A. Welding: Qualify procedures and personnel according to the following:
 - 1. AWS D1.1, "Structural Welding Code--Steel."
 - 2. AWS D1.2, "Structural Welding Code--Aluminum."
 - 3. AWS D1.3, "Structural Welding Code--Sheet Steel."
 - 4. AWS D1.6, "Structural Welding Code--Stainless Steel."

1.5 ACTION SUBMITTALS

- A. Product Data: Submit specified information as follows:
 - 1. Manufacturer's product data, including manufacturer's technical data sheet.
 - 2. Catalog pages illustrating products to be incorporated into project and clearly indicating which product is to be incorporated.
 - a. Do NOT submit entire catalogs
- B. Shop Drawings:
 - 1. Include plans, sections, elevations, layout, spacings, sizes, thicknesses, and types of metal fabrications; fabrication; and fastening and anchorage details, including mechanical fasteners.
 - a. Indicate connection details with anchor brand (Simpson, Powers/DeWalt, Hilti, Red Head, etc.) and model types and locations, weld lengths and locations, fastening devices, and other fastener requirements.

- C. Delegated Design Submittals: Submit structural calculations as follows:
1. Unless otherwise noted, calculations shall be provided for all stairs/steps, railings, and ladders. Include any assembly noted as “delegated design” on the construction documents.
 2. Structural calculations prepared by manufacturer for approval. Submittal shall be sealed by a professional engineer registered in the State of Ohio.
 3. Description of design criteria.
 4. Engineering analysis depicting stress and deflection (stiffness) requirements for each framing application.
 5. Selection of framing components, accessories and welded connection requirements.
 6. Verification of attachments to structure and adjacent framing components.
 7. Include at least one brand and model of each post-installed anchor selected. Generic “wedge anchors” will not be accepted as capacities vary between brands and models.

1.6 PROJECT CONDITIONS

- A. Field Measurements: Verify actual locations of walls and other construction contiguous with metal fabrications by field measurements before fabrication and indicate measurements on Shop Drawings.

1.7 COORDINATION

- A. Coordinate installation of anchorages for metal fabrications. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in concrete or masonry. Deliver such items to Project site in time for installation.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.

2.2 METALS, GENERAL

- A. Metal Surfaces, General: Provide materials with smooth, flat surfaces, unless otherwise indicated. For metal fabrications exposed to view in the completed Work, provide materials without seam marks, roller marks, rolled trade names, or blemishes.

2.3 FERROUS METALS

- A. Steel Plates, Shapes, and Bars: ASTM A 36/A 36M.
- B. Steel Tubing: ASTM A 500, Grade C, cold-formed steel tubing.

- C. Steel Pipe: ASTM A 53/A 53M, standard weight (Schedule 40), unless another weight is indicated or required by structural loads.

2.4 NONFERROUS METALS

- A. Aluminum Plate and Sheet: ASTM B 209, Alloy 6061-T6.
- B. Aluminum Extrusions: ASTM B 221, Alloy 6063-T6.

2.5 FASTENERS

- A. General: Unless otherwise indicated, provide Type 304 stainless-steel fasteners for exterior use and zinc-plated fasteners with coating complying with ASTM B 633, Class Fe/Zn 5, at exterior walls. Provide stainless-steel fasteners for fastening aluminum. Select fasteners for type, grade, and class required.
- B. Steel Bolts and Nuts: Regular hexagon-head bolts, ASTM A 307, Grade A; with hex nuts, ASTM A 563; and, where indicated, flat washers.
- C. Stainless-Steel Bolts and Nuts: Regular hexagon-head annealed stainless-steel bolts, nuts and, where indicated, flat washers; ASTM F 593 for bolts and ASTM F 594 for nuts, Alloy Group 1.
- D. Anchor Bolts: ASTM F 1554, Grade 36.
 - 1. Provide hot-dip or mechanically deposited, zinc-coated anchor bolts where item being fastened is indicated to be galvanized.
- E. Expansion Anchors: Anchor bolt and sleeve assembly with capability to sustain, without failure, a load equal to six times the load imposed when installed in unit masonry and four times the load imposed when installed in concrete, as determined by testing according to ASTM E 488, conducted by a qualified independent testing agency.

2.6 MISCELLANEOUS MATERIALS

- A. Welding Rods and Bare Electrodes: Select according to AWS specifications for metal alloy welded.
- B. Universal Shop Primer: Fast-curing, lead- and chromate-free, universal modified-alkyd primer complying with MPI#79.
- C. Zinc-Rich Primer: Complying with SSPC-Paint 20 or SSPC-Paint 29 and compatible with topcoat.
 - 1. Products:
 - a. Benjamin Moore & Co.; Epoxy Zinc-Rich Primer CM18/19.
 - b. Carboline Company; Carbozinc 621.
 - c. ICI Devco Coatings; Catha-Coat 313.
 - d. International Coatings Limited; Interzinc 315 Epoxy Zinc-Rich Primer.
 - e. PPG Architectural Finishes, Inc.; Aquapon Zinc-Rich Primer 97-670.
 - f. Sherwin-Williams Company (The); Corothane I GalvaPac Zinc Primer.
 - g. Tnemec Company, Inc.; Tneme-Zinc 90-97.

- D. Galvanizing Repair Paint: High-zinc-dust-content paint for regalvanizing welds in steel, complying with SSPC-Paint 20.
- E. Bituminous Paint: Cold-applied asphalt emulsion complying with ASTM D 1187.

2.7 FABRICATION, GENERAL

- A. Shop Assembly: Preassemble items in the shop to greatest extent possible. Disassemble units only as necessary for shipping and handling limitations. Use connections that maintain structural value of joined pieces. Clearly mark units for reassembly and coordinated installation.
- B. Cut, drill, and punch metals cleanly and accurately. Remove burrs and ease edges to a radius of approximately 1/32 inch, unless otherwise indicated. Remove sharp or rough areas on exposed surfaces.
- C. Provide for anchorage of type indicated; coordinate with supporting structure. Space anchoring devices to secure metal fabrications rigidly in place and to support indicated loads.

2.8 MISCELLANEOUS FRAMING AND SUPPORTS

- A. General: Provide steel framing and supports not specified in other Sections as needed to complete the Work.
- B. Fabricate units from steel shapes, plates, and bars of welded construction, unless otherwise indicated. Fabricate to sizes, shapes, and profiles indicated and as necessary to receive adjacent construction retained by framing and supports. Cut, drill, and tap units to receive hardware, hangers, and similar items.
 - 1. At locations of roof opening infill, provide steel shapes of sufficient size and placement to maintain structural continuity of existing and new metal decking infill.
 - 2. 4" x 4" x .375" minimum angle size or match existing.
 - 3. Metal decking type, gauge and profile shall be minimum 22 ga galvanized steel decking in profiles to match existing.
- C. Galvanize miscellaneous framing and supports where indicated.
- D. Prime miscellaneous framing and supports with zinc-rich primer where indicated.

2.9 LOOSE STEEL LINTELS

- A. Fabricate loose steel lintels from steel angles and shapes of size indicated for openings and recesses in masonry walls and partitions at locations indicated.
- B. Size loose lintels to provide bearing length at each side of openings equal to 1/12 of clear span but not less than 8 inches, unless otherwise indicated.
- C. Galvanize loose steel lintels located in exterior walls.

2.10 SHELF ANGLES

- A. Fabricate shelf angles from steel angles of sizes indicated and for attachment to concrete or masonry. Provide horizontally slotted holes to receive 3/4-inch bolts, spaced not more than 6 inches from ends and 24 inches o.c., unless otherwise indicated.
 - 1. Provide mitered and welded units at corners.
 - 2. Provide open joints in shelf angles at expansion and control joints. Make open joint approximately 2 inches larger than expansion or control joint.
- B. Galvanize shelf angles located in exterior walls.
- C. Attach shelf angles to cast-in-place concrete or reinforced, grouted masonry, as indicated.

2.11 METAL LADDERS

- A. General:
 - 1. Comply with ANSI A14.3, unless otherwise indicated. Verify capacity per ASCE 7-10, 4.5.4 including extensions.
 - 2. Space siderails 18 inches apart, unless otherwise indicated.
 - 3. Support each ladder at top and bottom and not more than 60 inches o.c. with welded or bolted brackets, made from same metal as ladder.
 - 4. All ladder anchorage shall extend through any face brick and rely solely on concrete masonry units or direct anchorage to metal studs for tension capacity. All ladder anchors shall be designed for the loads as calculated in ASCE 7, but no less than 250# tension and shear (not simultaneous) at each location.
- B. Steel Ladders:
 - 1. Siderails: Continuous, no less than 3/8-by-2-1/2-inch steel flat bars, with eased edges, as required by structural analysis.
 - 2. Rungs: 3/4-inch- square steel bars.
 - 3. Fit rungs in centerline of siderails; plug-weld and grind smooth on outer rail faces.
 - 4. Provide nonslip surfaces on top of each rung, either by coating rung with aluminum-oxide granules set in epoxy-resin adhesive or by using a type of manufactured rung filled with aluminum-oxide grout.
 - 5. Provide nonslip surfaces on top of each rung by coating with abrasive material metallically bonded to rung by a proprietary process.
 - 6. Galvanize exterior ladders including brackets and fasteners.
 - 7. Prime interior ladders, including brackets and fasteners, with zinc-rich primer except where indicated to be galvanized.
- C. Aluminum Ladders:
 - 1. Siderails: Continuous extruded-aluminum channels or tubes, not less than 2-1/2 inches deep, 3/4 inch wide, and 1/8 inch thick.
 - 2. Rungs: Extruded-aluminum tubes, not less than 3/4 inch deep and not less than 1/8 inch thick, with ribbed tread surfaces.
 - 3. Fit rungs in centerline of siderails; fasten by welding or with stainless-steel fasteners or brackets and aluminum rivets.

2.12 FINISHES, GENERAL

- A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
- B. Finish metal fabrications after assembly.

2.13 STEEL AND IRON FINISHES

- A. Galvanizing: Hot-dip galvanize items as indicated to comply with applicable standard listed below:
 - 1. ASTM A 123/A 123M, for galvanizing steel and iron products.
- B. Preparation for Shop Priming: Prepare uncoated ferrous-metal surfaces to comply with minimum requirements indicated below for SSPC surface preparation specifications and environmental exposure conditions of installed metal fabrications:
- C. Shop Priming: Apply shop primer to uncoated surfaces of metal fabrications, except those with galvanized finishes and those to be embedded in concrete, sprayed-on fireproofing, or masonry, unless otherwise indicated. Comply with SSPC-PA 1, "Paint Application Specification No. 1: Shop, Field, and Maintenance Painting of Steel," for shop painting.

2.14 ALUMINUM FINISHES

- A. Finish designations prefixed by AA comply with the system established by the Aluminum Association for designating aluminum finishes.
- B. Class I, Clear Anodic Finish: AA-M12C22A41 (Mechanical Finish: nonspecular as fabricated; Chemical Finish: etched, medium matte; Anodic Coating: Architectural Class I, clear coating 0.018 mm or thicker) complying with AAMA 611.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

- A. Cutting, Fitting, and Placement: Perform cutting, drilling, and fitting required for installing metal fabrications. Set metal fabrications accurately in location, alignment, and elevation; with edges and surfaces level, plumb, true, and free of rack; and measured from established lines and levels.
- B. Field Welding: Comply with the following requirements:
 - 1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
 - 2. Obtain fusion without undercut or overlap.
 - 3. Remove welding flux immediately.
 - 4. At exposed connections, finish exposed welds and surfaces smooth and blended so no roughness shows after finishing and contour of welded surface matches that of adjacent surface.

- C. Fastening to In-Place Construction: Provide anchorage devices and fasteners where metal fabrications are required to be fastened to in-place construction. Provide threaded fasteners for use with concrete and masonry inserts, toggle bolts, through bolts, lag bolts, wood screws, and other connectors.
- D. Provide temporary bracing or anchors in formwork for items that are to be built into concrete, masonry, or similar construction.
- E. Corrosion Protection: Coat concealed surfaces of aluminum that will come into contact with grout, concrete, masonry, wood, or dissimilar metals with a heavy coat of bituminous paint.

3.2 INSTALLING MISCELLANEOUS FRAMING AND SUPPORTS

- A. General: Install framing and supports to comply with requirements of items being supported, including manufacturers' written instructions and requirements indicated on Shop Drawings.

3.3 ADJUSTING AND CLEANING

- A. Touchup Painting: Immediately after erection, clean field welds, bolted connections, and abraded areas. Paint uncoated and abraded areas with the same material as used for shop painting to comply with SSPC-PA 1 for touching up shop-painted surfaces.
 - 1. Apply by brush or spray to provide a minimum 2.0-mil dry film thickness.
- B. Touchup Painting: Cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint are specified in Division 09 painting Sections.
- C. Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas and repair galvanizing to comply with ASTM A 780.

END OF SECTION 055000

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DIVISION

WOODS, PLASTICS AND COMPOSITES

SECTION 061000 - ROUGH CARPENTRY

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This Section includes the following:
 - 1. Rooftop equipment bases and support curbs.
 - 2. Wood blocking and nailers.

1.3 DEFINITIONS

- A. Dimension Lumber: Lumber of 2 inches nominal or greater but less than 5 inches nominal in least dimension.

1.4 SUBMITTALS

- A. Product Data: For each type of process and factory-fabricated product. Indicate component materials and dimensions and include construction and application details.

PART 2 - PRODUCTS

2.1 WOOD PRODUCTS, GENERAL

- A. Lumber: DOC PS 20 and applicable rules of grading agencies indicated. If no grading agency is indicated, provide lumber that complies with the applicable rules of any rules-writing agency certified by the ALSC Board of Review. Provide lumber graded by an agency certified by the ALSC Board of Review to inspect and grade lumber under the rules indicated.
 - 1. Provide dressed lumber, S4S, unless otherwise indicated.

2.2 WOOD-PRESERVATIVE-TREATED LUMBER

- A. Preservative Treatment by Pressure Process: AWPA C2, except that lumber that is not in contact with the ground and is continuously protected from liquid water may be treated according to AWPA C31 with inorganic boron (SBX).
 - 1. Preservative Chemicals: Acceptable to authorities having jurisdiction and containing no arsenic or chromium.

- B. Kiln-dry lumber after treatment to a maximum moisture content of 19 percent. Do not use material that is warped or does not comply with requirements for untreated material.
- C. Application: Treat items indicated on Drawings, and the following:
 - 1. Wood cants, nailers, curbs, equipment support bases, blocking, stripping, and similar members in connection with roofing, flashing, vapor barriers, and waterproofing.
 - 2. Wood sills, sleepers, blocking, furring, stripping, and similar concealed members in contact with masonry or concrete.

2.3 MISCELLANEOUS LUMBER

- A. General: Provide miscellaneous lumber indicated and lumber for support or attachment of other construction, including the following:
 - 1. Blocking.
 - 2. Nailers.
 - 3. Rooftop equipment bases and support curbs.
 - 4. Cants.
 - 5. Furring.

2.4 FASTENERS

- A. General: Provide fasteners of size and type indicated that comply with requirements specified in this Article for material and manufacture.
 - 1. Where rough carpentry is exposed to weather, in ground contact, pressure-preservative treated, or in area of high relative humidity, provide fasteners of Type 304 stainless steel.

PART 3 - EXECUTION

3.1 WOOD GROUND, SLEEPER, BLOCKING, AND NAILER INSTALLATION

- A. Install where indicated and where required for attaching other work. Form to shapes indicated and cut as required for true line and level of attached work. Coordinate locations with other work involved.
- B. Provide permanent grounds of dressed, pressure-preservative-treated, key-beveled lumber not less than 1-1/2 inches wide and of thickness required to bring face of ground to exact thickness of finish material. Remove temporary grounds when no longer required.

3.2 PROTECTION

- A. Protect wood that has been treated with inorganic boron (SBX) from weather. If, despite protection, inorganic boron-treated wood becomes wet, apply EPA-registered borate treatment. Apply borate solution by spraying to comply with EPA-registered label.
- B. Protect rough carpentry from weather. If, despite protection, rough carpentry becomes wet, apply EPA-registered borate treatment. Apply borate solution by spraying to comply with EPA-registered label.

END OF SECTION 061000

SECTION 061600 - SHEATHING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes the following:

- 1. Wall sheathing.

1.3 SUBMITTALS

- A. Product Data: For each type of process and factory-fabricated product. Indicate component materials and dimensions and include construction and application details.

- 1. For building wrap, include data on air-/moisture-infiltration protection based on testing according to referenced standards.

1.4 QUALITY ASSURANCE

- A. Fire-Test-Response Characteristics: For assemblies with fire-resistance ratings, provide materials and construction identical to those of assemblies tested for fire resistance per ASTM E 119 by a testing and inspecting agency acceptable to authorities having jurisdiction.

- 1. Fire-Resistance Ratings: Indicated by design designations from UL's "Fire Resistance Directory."

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Stack plywood and other panels flat with spacers between each bundle to provide air circulation. Provide for air circulation around stacks and under coverings.

PART 2 - PRODUCTS

2.1 GYPSUM SHEATHING

- A. Gypsum Sheathing: ASTM C 79/C 79M or ASTM C 1396/C 1396M, gypsum sheathing; with water-resistant-treated core and with water-repellent fiberglass mat face surface bonded to core's face, back, and long edges.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. G-P Gypsum Corporation., Dens-Glass Gold (Design Standard)
 - b. National Gypsum Company.
 - c. United States Gypsum Co.
2. Type and Thickness: As Indicated.
 - a. Minimum: 5/8 inch.
3. Edge and End Configuration: V-shaped, tongue-and-groove long edges; square ends.
4. Size: 48 by 96 inches for horizontal installation.

2.2 WALL SHEATHING

- A. Plywood Sheathing: Exposure 1 sheathing.
 1. Span Rating: Not less than 16/0
 2. Nominal Thickness: Not less than 1/2 inch.

2.3 ROOF SHEATHING

- A. Plywood Sheathing: Exposure 1 sheathing.
 1. Span Rating: Not less than 24/0
 2. Nominal Thickness: Not less than 1/2 inch.

2.4 FASTENERS

- A. General: Provide fasteners of size and type indicated that comply with requirements of manufacturer's recommendations.
 1. Screws, metal: Wafer head, rust-resistant, Type S-12 drill or Hi-Lo, min. 1" length or Type W rust-resistant bugle head, coarse thread, sharp point for wood.

2.5 FASTENERS

- A. General: Provide fasteners of size and type indicated that comply with requirements specified in this article for material and manufacture.
 1. For roof, parapet and wall sheathing, provide fasteners with hot-dip zinc coating complying with ASTM A153/A153M.

2.6 SEALANTS

- A. Sealants, caulk and tape:
 1. Dow corning 795 or equivalent; Percora 895 or equivalent.

2. Borden HPPG Elmers Siliconized Acrylic Latex Caulk or equivalent; Pecora AC-20 acrylic latex sealant; GE Silicone Silpruf Sealant; Tremco Dymonic
3. 3.2" wide 10 x 10 glass mesh Quick Tape or equivalent.

2.7 AIR INFILTRATION BARRIER/BUILDING WRAP

- A. Building Wrap: ASTM E 1677, Type I air retarder; with flame-spread and smoke-developed indexes of less than 25 and 450, respectively, when tested according to ASTM E 84; UV stabilized; and acceptable to authorities having jurisdiction.
 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. DuPont (E. I. du Pont de Nemours and Company); Tyvek CommercialWrap.
 2. Water-Vapor Permeance: Not less than 152 g through 1 sq. m of surface in 24 hours per ASTM E 96, Desiccant Method (Procedure A).
 3. Allowable UV Exposure Time: Not less than three months.
- B. Building-Wrap Tape: Pressure-sensitive plastic tape recommended by building-wrap manufacturer for sealing joints and penetrations in building wrap.

2.8 MISCELLANEOUS MATERIALS

- A. Flexible Flashing: Composite, self-adhesive, flashing product consisting of a pliable, rubberized-asphalt compound, bonded to a high-density, cross-laminated polyethylene film to produce an overall thickness of not less than 0.030 inch (0.8 mm).
 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Carlisle Coatings & Waterproofing; CCW-705-TWF Thru-Wall Flashing.
 - b. Grace Construction Products, a unit of W. R. Grace & Co. - Conn.; Vycor V40 Weather Barrier Strips.
- B. Primer for Flexible Flashing: Product recommended by manufacturer of flexible flashing for substrate.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Examine subframing; verify that surface of framing and furring members to receive sheathing does not vary more than 1/4" from the plane of faces of adjacent members.

3.2 SHEATHING/WALL

- A. Provide Dens-Glass Gold sheathing where indicated on drawings. Install sheathing in accordance with manufacturer's instructions and applicable instructions in GA-253 and ASTM C 1280.
- B. Install Dens-Glass Gold sheathing with gold side out.

- C. Use maximum lengths possible to minimize number of joints.
- D. Metal Framing: Attach sheathing to metal framing with screws spaced 8" o.c. at perimeter where there are framing supports; and 8" o.c. along intermediate framing in field.
- E. Drive fasteners to bear tight against and flush with surface of sheathing. Do not countersink.
- F. Locate fasteners minimum 3/8" from edges and ends of sheathing panels.
- G. Finishing:
 - 1. Seal fasteners using Dow Corning 795 or Borden HPPG Elmers Siliconized Acrylic Latex Caulk or equivalent.
 - 2. Finish joints using Dow Corning 795 or Borden HPPG Elmers Siliconized Acrylic Latex Caulk or equivalent. Reinforce with 2" wide 10 x 10 glass mesh Quick tape or equivalent.

3.3 INSTALLATION, GENERAL

- A. Do not use materials with defects that impair quality of sheathing or pieces that are too small to use with minimum number of joints or optimum joint arrangement.
- B. Cut panels at penetrations, edges, and other obstructions of work; fit tightly against abutting construction, unless otherwise indicated.
- C. Securely attach to substrate by fastening as indicated, complying with the following:
 - 1. NES NER-272 for power-driven fasteners.
- D. Use common wire nails, unless otherwise indicated. Select fasteners of size that will not fully penetrate members where opposite side will be exposed to view or will receive finish materials. Make tight connections. Install fasteners without splitting wood.
- E. Coordinate wall sheathing installation with flashing and joint-sealant installation so these materials are installed in sequence and manner that prevent exterior moisture from passing through completed assembly.
- F. Do not bridge building expansion joints; cut and space edges of panels to match spacing of structural support elements.
- G. Coordinate sheathing installation with installation of materials installed over sheathing so sheathing is not exposed to precipitation or left exposed at end of the workday when rain is forecast.

3.4 AIR INFILTRATION BARRIER/BUILDING WRAP

- A. Building Wrap: Comply with manufacturer's written instructions.
 - 1. Seal seams, edges, fasteners, and penetrations with tape.
 - 2. Extend into jambs of openings and seal corners with tape.
 - 3. Apply building wrap over exterior gypsum sheathing.
 - 4. Extend building wrap up under metal cap.
 - 5. Where building wrap is penetrated by steel angle brackets supporting curtainwall, tape and seal building wrap to steel angle according to manufacturers recommendations.

END OF SECTION 061600

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DIVISION

THERMAL & MOISTURE PROTECTION

SECTION 070150.19 - PREPARATION FOR REROOFING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Full tear-off of roof system at areas indicated on Drawings.
2. Partial tear-off of roof areas indicated on Drawings.
3. Re-cover preparation of roof areas indicated on Drawings.
4. Removal of flashings and counterflashings.
5. Temporary roofing.

B. Related Requirements:

1. Section 011000 "Summary" for use of premises and for phasing requirements.
2. Section 015000 "Temporary Facilities and Controls" for temporary construction and environmental-protection measures for reroofing preparation.

1.3 ALLOWANCES

- A. Allowance for removal of existing wet insulation, and replacement with new insulation, is specified under Section 012100 "Allowances."
- B. Allowance for removal of existing deteriorated metal roof deck, and replacement with new metal roof deck, is specified under Section 012100 "Allowances."

1.4 UNIT PRICES

- A. Work of this Section is affected by insulation removal and replacement unit price and metal deck removal and replacement unit price.

1.5 DEFINITIONS

- A. Full Roof Tear-off: Removal of existing roofing system down to existing roof deck.
- B. OSB: Oriented strand board.
- C. Partial Roof Tear-off: Removal of selected components and accessories from existing roofing system.

- D. Roofing Terminology: Definitions in ASTM D1079 and glossary of NRCA's "The NRCA Roofing Manual: Membrane Roof Systems" apply to work of this Section.
- E. Roof Re-Cover Preparation: Existing roofing system is to remain and be prepared for new roof installed over it.

1.6 PREINSTALLATION MEETINGS

- A. Preliminary Roofing Conference: Before starting removal Work, conduct conference at Project site.
 - 1. Meet with Owner, Architect, Owner's insurer if applicable, testing and inspecting agency representative, roofing Installer, and installers whose work interfaces with or affects roofing, including installers of roof accessories and roof-mounted equipment.
 - 2. Review methods and procedures related to roofing tear-off, including, but not limited to, the following:
 - a. Reroofing preparation, including roofing system manufacturer's written instructions.
 - b. Temporary protection requirements for existing roofing system components that are to remain.
 - c. Existing roof drains and roof drainage during each stage of reroofing, and roof-drain plugging and plug removal.
 - d. Construction schedule and availability of materials, Installer's personnel, equipment, and facilities needed to avoid delays.
 - e. Existing roof deck conditions requiring Architect notification.
 - f. Existing roof deck removal procedures and Owner notifications.
 - g. Condition and acceptance of existing roof deck and base flashing substrate for reuse.
 - h. Structural loading limitations of roof deck during reroofing.
 - i. Base flashings, special roofing details, drainage, penetrations, equipment curbs, and condition of other construction that affect reroofing.
 - j. HVAC shutdown and sealing of air intakes.
 - k. Shutdown of fire-suppression, -protection, and -alarm and -detection systems.
 - l. Asbestos removal and discovery of asbestos-containing materials.
 - m. Governing regulations and requirements for insurance and certificates if applicable.
 - n. Existing conditions that may require Architect notification before proceeding.

1.7 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Temporary Roofing Submittal: Product data and description of temporary roofing system.
 - 1. If temporary roof remains in place, include surface preparation requirements needed to receive permanent roof, and submit a letter from roofing manufacturer stating acceptance of the temporary roof and that its inclusion does not adversely affect the new roofing system's resistance to fire and wind or specified special warranty.

1.8 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For Installer.
 - 1. Include certificate that Installer is approved by warrantor of existing roofing system.
 - 2. Include certificate that Installer is licensed to perform asbestos abatement.
- B. Field Test Reports:
 - 1. Fastener pull-out test report.
- C. Photographs or Videotape: Show existing conditions of adjoining construction and site improvements, including exterior and interior finish surfaces that might be misconstrued as having been damaged by reroofing operations.
 - 1. Submit before Work begins.
- D. Landfill Records: Indicate receipt and acceptance of demolished roofing materials and hazardous wastes, such as asbestos-containing materials, by a landfill facility licensed to accept them.
- E. Regulatory Requirements:
 - 1. Comply with governing EPA notification regulations before beginning roofing removal.
 - 2. Comply with hauling and disposal regulations of authorities having jurisdiction.

1.9 FIELD CONDITIONS

- A. Existing Roofing System: Combination of Built-up and ballasted single-ply membrane roofing.
- B. Owner will occupy portions of building immediately below reroofing area.
 - 1. Conduct reroofing so Owner's operations are not disrupted.
 - 2. Provide Owner with not less than 72 hours' written notice of activities that may affect Owner's operations.
 - 3. Coordinate work activities daily with Owner so Owner has adequate advance notice to place protective dust and water-leakage covers over sensitive equipment and furnishings, shut down HVAC and fire-alarm or -detection equipment if needed, and evacuate occupants from below work area.
 - 4. Before working over structurally impaired areas of deck, notify Owner to evacuate occupants from below affected area.
 - a. Verify that occupants below work area have been evacuated before proceeding with work over impaired deck area.
- C. Protect building to be reroofed, adjacent buildings, walkways, site improvements, exterior plantings, and landscaping from damage or soiling from reroofing operations.
- D. Maintain access to existing walkways, corridors, and other adjacent occupied or used facilities.

- E. Conditions existing at time of inspection for bidding will be maintained by Owner as far as practical.
1. A roof moisture survey of existing roofing system is available for Contractor's reference.
 2. The results of an analysis of test cores from existing roofing system are available for Contractor's reference.
 3. Construction Drawings for existing roofing system are provided for Contractor's convenience and information, but they are not a warranty of existing conditions. They are intended to supplement rather than serve in lieu of Contractor's own investigations. Contractor is responsible for conclusions derived from existing documents.
- F. Limit construction loads on existing roof areas to remain, and existing roof areas scheduled to be reroofed to 400 pounds for rooftop equipment wheel loads and 25 pounds per square foot for uniformly distributed loads.
- G. Weather Limitations: Proceed with reroofing preparation only when existing and forecasted weather conditions permit Work to proceed without water entering existing roofing system or building.
1. Remove only as much roofing in one day as can be made watertight in the same day.
- H. Hazardous Materials: It is not expected that hazardous materials, such as asbestos-containing materials, will be encountered in the Work.
1. If materials suspected of containing hazardous materials are encountered, do not disturb; immediately notify Architect and Owner.
 - a. Hazardous materials will be removed by Owner under a separate contract.

PART 2 - PRODUCTS

2.1 TEMPORARY PROTECTION MATERIALS

- A. EPS Insulation: ASTM C578.
- B. Plywood: DOC PS 1, Grade CD, Exposure 1.
- C. OSB: DOC PS 2, Exposure 1.

2.2 TEMPORARY ROOFING MATERIALS

- A. Design and selection of materials for temporary roofing are Contractor's responsibilities.
- B. Sheathing Paper: Red-rosin type, minimum 3 lb/100 sq. ft..
- C. Base Sheet: ASTM D4601/D4601M, Type II, nonperforated, asphalt-impregnated and -coated, glass-fiber sheet.
- D. Glass-Fiber Felts: ASTM D2178/D2178M, Type IV, asphalt-impregnated, glass-fiber felt.
- E. Asphalt Primer: ASTM D41/D41M.

- F. Roofing Asphalt: ASTM D312/D312M, Type III or IV.
- G. Base Sheet Fasteners: Capped head, factory-coated steel fasteners, listed in FM Approvals' RoofNav.

2.3 INFILL AND REPLACEMENT MATERIALS

- A. Use infill materials matching existing roofing system materials unless otherwise indicated.
- B. Steel deck is specified in Section 053100 "Steel Decking."
- C. Wood blocking, curbs, and nailers are specified in Section 061000 "Rough Carpentry."
- D. Plywood roof sheathing is specified in Section 061600 "Sheathing."
- E. Fasteners: Factory-coated steel fasteners with metal or plastic plates acceptable to new roofing system manufacturer.

2.4 AUXILIARY REROOFING MATERIALS

- A. General: Use auxiliary reroofing preparation materials recommended by roofing system manufacturer for intended use and compatible with components of existing and new roofing system.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Protection of In-Place Conditions:
 - 1. Protect existing roofing system that is not to be reroofed.
 - 2. Loosely lay 1-inch-minimum thick, EPS insulation over existing roofing in areas not to be reroofed.
 - a. Loosely lay 15/32-inch plywood or OSB panels over EPS. Extend EPS past edges of plywood or OSB panels a minimum of 1 inch.
 - 3. Limit traffic and material storage to areas of existing roofing that have been protected.
 - 4. Maintain temporary protection and leave in place until replacement roofing has been completed. Remove temporary protection on completion of reroofing.
 - 5. Comply with requirements of existing roof system manufacturer's warranty requirements.
- B. Seal or isolate windows that may be exposed to airborne substances created in removal of existing materials.
- C. Shut off rooftop utilities and service piping before beginning the Work.
- D. Test existing roof drains to verify that they are not blocked or restricted.
 - 1. Immediately notify Architect of any blockages or restrictions.

- E. Coordinate with Owner to shut down air-intake equipment in the vicinity of the Work.
 - 1. Cover air-intake louvers before proceeding with reroofing work that could affect indoor air quality or activate smoke detectors in the ductwork.
- F. During removal operations, have sufficient and suitable materials on-site to facilitate rapid installation of temporary protection in the event of unexpected rain.
- G. Maintain roof drains in functioning condition to ensure roof drainage at end of each workday.
 - 1. Prevent debris from entering or blocking roof drains and conductors.
 - a. Use roof-drain plugs specifically designed for this purpose.
 - b. Remove roof-drain plugs at end of each workday, when no work is taking place, or when rain is forecast.
 - 2. If roof drains are temporarily blocked or unserviceable due to roofing system removal or partial installation of new roofing system, provide alternative drainage method to remove water and eliminate ponding.
 - a. Do not permit water to enter into or under existing roofing system components that are to remain.

3.2 ROOF TEAR-OFF

- A. Notify Owner each day of extent of roof tear-off proposed for that day and obtain authorization to proceed.
- B. Lower removed roofing materials to ground and onto lower roof levels, using dust-tight chutes or other acceptable means of removing materials from roof areas.
- C. Remove aggregate ballast from roofing.
- D. Remove loose aggregate from aggregate-surfaced, built-up bituminous roofing using a power broom.
- E. Remove ballast, protection mat, and EPS insulation from protected roofing membrane.
 - 1. Discard EPS insulation that is damaged or exceeds 8 lb/cu. ft.
 - 2. Store EPS insulation for reuse and protect it from physical damage.
 - 3. Store ballast for reuse in manner not to exceed structural loading limitations of roof deck.
- F. Full Roof Tear-off: Where indicated on Drawings, remove existing roofing and other roofing system components down to the existing roof deck.
- G. Partial Roof Tear-off: Where indicated on Drawings, remove existing roofing down to existing cover board or existing insulation if cover board is not present, and immediately check for presence of moisture.
 - 1. Engage a qualified testing agency to perform the following test:
 - a. Coordinate with Owner's testing agency to schedule times for tests and inspections immediately after removal.

2. Survey exposed substrate that is to remain using infrared color thermography according to ASTM C1153.
 - a. Prepare survey report of initial scan indicating locations of entrapped moisture, if any, and area calculations of locations of entrapped moisture.
3. Survey exposed substrate that is to remain using electrical capacitance/impedance testing according to ASTM D7954/D7954M.
 - a. Prepare survey report indicating locations of entrapped moisture, if any, and area calculations of locations of entrapped moisture.
4. Survey exposed substrate that is to remain using nuclear hydrogen detection testing according to SPRI/RCI NT-1.
 - a. Prepare survey report indicating locations of entrapped moisture, if any, and area calculations of locations of entrapped moisture.
5. Remove wet or damp materials below existing roofing and above deck as directed by Architect.
 - a. Removal of areas outside of those indicated on the Contract Documents is paid for by adjusting the Contract Sum according to unit prices included in the Contract Documents.
6. Inspect wood blocking, curbs, and nailers for deterioration and damage.
 - a. If wood blocking, curbs, or nailers have deteriorated, immediately notify Architect.
7. Remove excess asphalt from steel deck that is exposed by removal of wet or damp materials.
 - a. A maximum of 15 lb/100 sq. ft. of asphalt is permitted to remain on steel decks.
8. Remove fasteners from deck or cut fasteners off slightly above deck surface.

3.3 DECK PREPARATION

- A. Inspect deck after tear-off of roofing system.
- B. If broken or loose fasteners that secure deck panels to one another or to structure are observed, or if deck appears or feels inadequately attached, immediately notify Architect.
 1. Do not proceed with installation until directed by Architect.
- C. If deck surface is unsuitable for receiving new roofing or if structural integrity of deck is suspect, immediately notify Architect.
 1. Do not proceed with installation until directed by Architect.
- D. Provide additional deck securement as indicated on Drawings.
- E. Replace steel deck as indicated on Drawings.
- F. Replace steel deck as directed by Architect.

1. Deck replacement will be paid for by adjusting the Contract Sum according to unit prices included in the Contract Documents.

G. Prepare and paint steel deck surface.

1. Painting and preparation for painting is specified in Section 099113 "Exterior Painting."

3.4 INFILL MATERIALS INSTALLATION

- A. Immediately after roof tear-off, and inspection and repair, if needed, of deck, fill in tear-off areas to match existing roofing system construction.

B. Install new roofing patch over roof infill area.

1. If new roofing is installed the same day tear-off is made, roofing patch is not required.

3.5 TEMPORARY ROOFING

- A. Install approved temporary roofing over area to be reroofed.

B. Install temporary roofing over area to be reroofed.

1. Mechanically fasten base sheet and install a glass-fiber felt, lapping each sheet 19 inches over preceding sheet.
2. Embed glass-fiber felt in a solid mopping of hot roofing asphalt applied within equiviscous temperature range.
3. Glaze-coat completed surface with hot roofing asphalt.

C. Remove temporary roofing before installing new roofing.

3.6 ROOF RE-COVER PREPARATION

- A. Remove blisters, ridges, buckles, mechanically attached roofing fastener buttons projecting above roofing, and other substrate irregularities from existing roofing that inhibit new recover boards from conforming to substrate.

1. Remove loose aggregate from aggregate-surfaced, built-up bituminous roofing with a power broom.
2. Broom clean existing substrate.
3. Coordinate with Owner's inspector to schedule times for tests and inspections.
4. Verify that existing substrate is dry.

- a. Spot check substrates with an electrical capacitance moisture-detection meter.

5. Remove materials that are wet or damp.
 - a. Removal of areas not identified in Contract Documents will be paid for by adjusting the Contract Sum according to unit prices included in the Contract Documents.

3.7 BASE FLASHING REMOVAL

- A. Remove existing base flashings.
 1. Clean substrates of contaminants, such as asphalt, sheet materials, dirt, and debris.
- B. Do not damage metal counterflashings that are to remain.
 1. Replace metal counterflashings damaged during removal with counterflashings of same metal, weight or thickness, and finish as existing.
- C. Inspect parapet sheathing, wood blocking, curbs, and nailers for deterioration and damage.
 1. If parapet sheathing, wood blocking, curbs, or nailers have deteriorated, immediately notify Architect.

3.8 FASTENER PULL-OUT TESTING

- A. Perform fastener pull-out tests according to SPRI FX-1, and submit test report to Architect and [roofing manufacturer before installing new roofing system.
 1. Obtain Roofing manufacturer's approval to proceed with specified fastening pattern.
 - a. Roofing manufacturer may furnish revised fastening pattern commensurate with pull-out test results.

3.9 DISPOSAL

- A. Collect demolished materials and place in containers.
 1. Promptly dispose of demolished materials.
 2. Do not allow demolished materials to accumulate on-site.
 3. Storage or sale of demolished items or materials on-site is not permitted.
- B. Transport and legally dispose of demolished materials off Owner's property.

END OF SECTION 070150.19

SECTION 072100 - THERMAL INSULATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:
 - 1. Extruded polystyrene foam-plastic board insulation.
 - 2. Glass-fiber blanket insulation.

1.3 ACTION SUBMITTALS

- A. Product Data: For the following:
 - 1. Extruded polystyrene foam-plastic board insulation.
 - 2. Glass-fiber blanket insulation.
 - 3. Spray-applied cellulosic insulation.

1.4 INFORMATIONAL SUBMITTALS

- A. Installer's Certification: Listing type, manufacturer, and R-value of insulation installed in each element of the building thermal envelope.
 - 1. Sign, date, and post the certification in a conspicuous location on Project site.
- B. Product Test Reports: For each product, for tests performed by a qualified testing agency.
- C. Research Reports: For foam-plastic insulation, from ICC-ES.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Protect insulation materials from physical damage and from deterioration due to moisture, soiling, and other sources. Store inside and in a dry location. Comply with manufacturer's written instructions for handling, storing, and protecting during installation.
- B. Protect foam-plastic board insulation as follows:
 - 1. Do not expose to sunlight except to necessary extent for period of installation and concealment.
 - 2. Protect against ignition at all times. Do not deliver foam-plastic board materials to Project site until just before installation time.

3. Quickly complete installation and concealment of foam-plastic board insulation in each area of construction.

PART 2 - PRODUCTS

2.1 EXTRUDED POLYSTYRENE FOAM-PLASTIC BOARD INSULATION

- A. Extruded Polystyrene Board Insulation, Type IV: ASTM C578, Type IV, 25-psi minimum compressive strength; unfaced.
 1. **Manufacturers:** Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. [Dow Chemical Company \(The\) – Perimate XPS.](#)
 - b. [Owens Corning – Formular 250 XPS.](#)
 2. R-Value = 5 min. per inch.
 3. Foundation insulation.
- B. Extruded Polystyrene Board Insulation, Type IV: ASTM C578, Type IV, 25-psi minimum compressive strength; unfaced.
 1. **Manufacturers:** Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
 - a. [Dow Chemical Company \(The\) – Cavity Mate Ultra.](#)
 - b. [Owens Corning – Formular High-R CW+.](#)
 2. Flame-Spread Index: Not more than 25 when tested in accordance with ASTM E84.
 3. Smoke-Developed Index: Not more than 450 when tested in accordance with ASTM E84.
 4. Fire Propagation Characteristics: Passes NFPA 285 testing as part of an approved assembly.
 5. Labeling: Provide identification of mark indicating R-value of each piece of insulation 12 inches and wider in width.
 6. R-Value: 5.6 min. per inch.
 7. Above grade wall applications.

2.2 GLASS-FIBER BLANKET INSULATION

- A. Glass-Fiber Blanket Insulation, Unfaced: ASTM C665, Type I; passing ASTM E136 for combustion characteristics.
 1. **Manufacturers:** Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
 - a. [CertainTeed Corporation – Sustainable Fiber Glass Insulation.](#)
 - b. [Knauf Insulation – Eco Batt.](#)
 - c. [Owens Corning Eco Touch Pink.](#)
 2. Flame-Spread Index: Not more than 25 when tested in accordance with ASTM E84.
 3. Smoke-Developed Index: Not more than 50 when tested in accordance with ASTM E84.

4. Labeling: Provide identification of mark indicating R-value of each piece of insulation 12 inches and wider in width.
5. R-Value = 21 at 6" thick.

2.3 INSULATION FASTENERS

- A. Adhesively Attached, Spindle-Type Anchors: Plate welded to projecting spindle; capable of holding insulation of specified thickness securely in position with self-locking washer in place.
 1. **Manufacturers:** Subject to compliance with requirements, provide products by one of the following:
 - a. [AGM Industries, Inc.](#)
 - b. [Gemco.](#)
 2. Plate: Perforated, galvanized carbon-steel sheet, 0.030 inch thick by 2 inches square.
 3. Spindle: Copper-coated, low-carbon steel; fully annealed; 0.105 inch in diameter; length to suit depth of insulation.
 4. Only permitted for foundation locations
- B. Self-Drilling Screw Fastener with Solid Cap Washer.
 1. Roden House "Thermal Grip ci" System or approved equal for wall assemblies.

2.4 ACCESSORIES

- A. Insulation for Miscellaneous Voids:
 1. Glass-Fiber Insulation: ASTM C764, Type II, loose fill; with maximum flame-spread and smoke-developed indexes of 5, per ASTM E84.
 2. Spray Polyurethane Foam Insulation: ASTM C1029, Type II, closed cell, with maximum flame-spread and smoke-developed indexes of 75 and 450, respectively, per ASTM E84.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Clean substrates of substances that are harmful to insulation, including removing projections capable of puncturing insulation or vapor retarders, or that interfere with insulation attachment.

3.2 INSTALLATION, GENERAL

- A. Comply with insulation manufacturer's written instructions applicable to products and applications.
- B. Install insulation that is undamaged, dry, and unsoiled and that has not been left exposed to ice, rain, or snow at any time.
- C. Install insulation with manufacturer's R-value label exposed after insulation is installed.

- D. Extend insulation to envelop entire area to be insulated. Fit tightly around obstructions and fill voids with insulation. Remove projections that interfere with placement.
- E. Provide sizes to fit applications and selected from manufacturer's standard thicknesses, widths, and lengths. Apply single layer of insulation units unless multiple layers are otherwise shown or required to make up total thickness or to achieve R-value.

3.3 INSTALLATION OF SLAB INSULATION

- A. On vertical slab edge and foundation surfaces, set insulation units using manufacturer's recommended adhesive according to manufacturer's written instructions.
 - 1. If not otherwise indicated, extend insulation a minimum of 24 inches below exterior grade line.

3.4 INSTALLATION OF FOUNDATION WALL INSULATION

- A. Butt panels together for tight fit.
- B. Anchor Installation: Install board insulation on concrete substrates by adhesively attached, spindle-type insulation anchors as follows:
 - 1. Fasten insulation anchors to concrete substrates with insulation anchor adhesive according to anchor manufacturer's written instructions.
 - 2. Space anchors according to insulation manufacturer's written instructions for insulation type, thickness, and application.
 - 3. Apply insulation standoffs to each spindle to create cavity width indicated on Drawings between concrete substrate and insulation.
 - 4. After adhesive has dried, install board insulation by pressing insulation into position over spindles and securing it tightly in place with insulation-retaining washers, taking care not to compress insulation.
 - 5. Where insulation will not be covered by other building materials, apply capped washers to tips of spindles.

3.5 INSTALLATION OF CAVITY-WALL INSULATION

- A. Foam-Plastic Board Insulation: Utilize screw/washer fasteners as recommended by insulation manufacturer.
 - 1. Fit courses of insulation between wall ties and other obstructions, with edges butted tightly in both directions, and with faces flush.
 - 2. Press units firmly against inside substrates.

3.6 INSTALLATION OF INSULATION IN FRAMED CONSTRUCTION

- A. Blanket Insulation: Install in cavities formed by framing members according to the following requirements:
 - 1. Use insulation widths and lengths that fill the cavities formed by framing members. If more than one length is required to fill the cavities, provide lengths that will produce a snug fit between ends.
 - 2. Place insulation in cavities formed by framing members to produce a friction fit between edges of insulation and adjoining framing members.
 - 3. Maintain 3-inch clearance of insulation around recessed lighting fixtures not rated for or protected from contact with insulation.
 - 4. For metal-framed wall cavities where cavity heights exceed 96 inches, support unfaced blankets mechanically and support faced blankets by taping flanges of insulation to flanges of metal studs.

- B. Miscellaneous Voids: Install insulation in miscellaneous voids and cavity spaces where required to prevent gaps in insulation using the following materials:
 - 1. Glass-Fiber Insulation: Compact to approximately 40 percent of normal maximum volume equaling a density of approximately 2.5 lb/cu. ft..
 - 2. Spray Polyurethane Insulation: Apply according to manufacturer's written instructions.

3.7 PROTECTION

- A. Protect installed insulation from damage due to harmful weather exposures, physical abuse, and other causes.

- B. Provide temporary coverings or enclosures where insulation is subject to abuse and cannot be concealed and protected by permanent construction immediately after installation.

END OF SECTION 072100

SECTION 072723 - SPRAY POLYURETHANE FOAM INSULATION AND AIR BARRIER SYSTEM

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes: Spray polyurethane foam insulation and air barrier system, where indicated and as follows:
 - 1. All roof deck penetrations, all roof drain locations, including the open ends of metal deck flutes and roof drain bodies.
 - 2. Expansion joints in roofs.
 - 3. Openings and penetrations of window frames, storefront, and curtain wall.
 - 4. Piping, conduit, duct and similar penetrations in the exterior envelope.

1.3 DEFINITIONS

- A. Air Barrier Assembly: The collection of air barrier materials and auxiliary materials applied to an opaque wall, including joints and junctions to abutting construction, to control air movement through the wall.

1.4 PERFORMANCE REQUIREMENTS

- A. General: Air barrier shall be capable of performing as a continuous vapor-retarding air barrier. Air barrier assemblies shall be capable of accommodating substrate movement and of sealing substrate expansion and control joints, construction material changes, penetrations, and transitions at perimeter conditions without deterioration and air leakage exceeding specified limits.
- B. Material Performance: Provide materials which have an air permeance not to exceed 0.004 cubic feet per minute per square foot under a pressure differential of 0.3 in. water (1.57 psf) (0.02 L/sm @ 75 Pa.) when tested according to ASTM E 2178.
- C. Spray Polyurethane Foam: Material shall meet the following requirements:
 - 1. Class A UL Tested: Smoke development not greater than 450 and flame spread not greater than 25 when tested in accordance with ASTM E 84.
 - 2. Tested in accordance with the acceptance criteria of NFPA 285.
 - 3. Fire resistance compliance in wall and ceiling assemblies in accordance with ASTM E 119.

1.5 SUBMITTALS

- A. Shop Drawings: Show locations and extent of air barrier. Include details for substrate joints and cracks, counter flashing strip, penetrations, inside and outside corners, terminations, and tie-ins with adjoining construction.
 - 1. Include statement that materials are compatible with adjacent materials for proposed use.
- B. Quality Assurance/Control Submittals:

1. Product Data: For materials proposed and application instructions, including instructions for evaluating, preparing, and treating substrate, temperature, and other limitations of insulation conditions.
 - a. Provide data on materials, describing insulation properties and surface burning characteristics.
 - b. Manufacturer's installation instructions indicating special procedures and perimeter conditions requiring special treatments.
 - c. Include statement that materials are adhesively and chemical compatible with adjacent materials proposed for use.

1.6 QUALITY ASSURANCE

- A. Manufacturer: Obtain primary materials from a single manufacturer regularly engaged in manufacturing air barrier membranes. Obtain secondary materials from a source acceptable to the primary materials manufacturer.
- B. Field Quality Assurance: Follow the manufacturer's guidelines for installation and quality control. Cooperate with inspectors and independent testing and inspection agencies engaged by the Owner. Do not cover air barrier until it has been inspected, tested and accepted.
- C. Protect people and materials from over-spray and contact with chemicals and gases.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Material to be used shall be delivered in original unopened packages bearing the name of the manufacturer and the brand, expiration date, and direction for storage.
- B. Store materials in their original undamaged packages in a clean, dry, protected location and within temperature range required by system manufacturer. Protect materials from direct sunlight. Stock of material is to be rotated and used before its expiration date.
- C. Avoid spillage. Immediately notify Owner or Owner's agent if spillage occurs and start cleanup procedures. Clean spills and leave area as it was prior to spill.

1.8 PROJECT CONDITIONS

- A. Environmental Conditions: Apply insulation within range of ambient and substrate temperatures recommended by manufacturer. Do not apply to a damp or wet substrate, unless the manufacturer specifically permits that for the products.
 1. Do not apply in snow, rain, fog, or mist.
 2. Do not apply when the temperature of substrate surfaces and surrounding air temperatures are below or above those recommended by the manufacturer.
 3. The product shall not be installed after the expiration date printed on the label of each container.
- B. Substrate: Proceed with spray polyurethane foam application only after substrate construction, penetration work, and relating welding and other hot work has been completed. Verify that mortar has cured sufficiently and masonry substrate is dry to manufacturer's requirements.

1.9 SEQUENCING

- A. Sequence and coordinate application of insulation with other related Work specified in other Sections to comply with the following requirements:

1. Ensure that insulating material is installed prior to installation of enclosing or concealing work, with sufficient time allowed for observation, testing, and correction of defective insulation work.
- B. Coordinate installation of insulation with other Work in order to minimize the need for other trades to cut or remove insulation. As other trades successively complete installation of their Work, maintain integrity of insulation coating by patching areas that have been removed or damaged prior to concealment by other Work.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Provide the following Class A rated, (UL Certified for flame spread and smoke), spray polyurethane foam and applied ignition barrier.
1. Dow – Froth-Pak Spray Polyurethane Foam system.
 2. Icynene ProSeal Eco– MD-R-210
 3. Lapolla
 4. Tiger Foam
- B. Provide one of the following ignition barrier systems for all exposed (Non-concealed or enclosed) installations of spray foam product that requires this barrier for compliance with requirements.
1. DC315 @4 wet mils (3 dry mils)
 2. NoBurn Plus XD @5 wet mils (3 dry mils)

2.2 MATERIALS

- A. Spray Closed-Cell Polyurethane Foam: Sprayed-in-place two-component closed-cell polyurethane made by combining an isocyanate (A) component with a polyol (B) component, with the following physical characteristics:

Property	Value	Units	Test Method
Core Density	1.9 – 2.2	lb/ft ³	ASTM D-1622
Water Vapor Transmission	< 1.0 @ 2” thick	perms	ASTM E-96
R-Value	6.0 (min) @ 1” thick	hr/ft ² F/Btu	ASTM C-518
Compressive Strength	23 (min)	psi	ASTM D-1621
Flame Spread	<25		ASTM E-84
Smoke Developed	<450		ASTM E-84
Tensile Bond Strength	>45 for masonry >15 for gypsum sheathing	psi	ASTM C-297
Hydrostatic Pressure Resistance	No failure @ 184.9 cm head pressure		AATCC 127

2.3 AUXILIARY MATERIALS

- A. Primer: Water based liquid primer for concrete, masonry, gypsum sheathing, wood, metal, and painted substrates.
- B. Sprayed Polyurethane Foam Sealant: 1 or 2 component, foamed in-place, polyurethane foam sealant, 1.5 to 2.0 lb/cu.ft. density; flame spread index of 25 or less according to ASTM E 162; with primer and noncorrosive substrate cleaner recommended by foam sealant manufacturer.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions under which insulation will be applied, with Installer present, for compliance with requirements. Verify that surfaces and conditions are suitable prior to commencing work of this Section. Do not proceed with installation until unsatisfactory conditions have been corrected.
 - 1. Do not proceed with installation until after minimum concrete curing period recommended by manufacturer.

3.2 PREPARATION

- A. Comply with manufacturer's written installation instructions for preparing substrates indicated to receive insulation.
 - 1. Clean, prepare, and treat substrate according to manufacturer's written instructions. Provide clean, dust-free, and dry substrate for application.
- B. Cover other Work that might be damaged by fall out or overspray of insulation materials during application.
- C. Remove foreign materials, dirt, grease, oil, paint, laitance, efflorescence, and other substances that will affect application.
- D. Ensure that all work by other trades that may penetrate through insulation is in place and complete.
- E. Install transition membranes to all applicable surfaces and ensure proper adhesion of the transition membranes to the substrate, capable of having spray polyurethane foam insulation.

3.3 APPLICATION

- A. Application of sprayed insulation shall be in accordance with the printed instructions of the material manufacturer and shall be installed by skilled craftsmen. Apply insulation to a reasonably uniform monolithic density without voids.
 - 1. Tolerances: Maximum variation from indicated thickness: Minus (-) 1/4 inch; plus (+) 1/2 inch.
 - 2. Apply in consecutive passes as recommended by manufacturer to thickness as indicated on Drawings. Passes shall be not less than 1/2 inch and not greater than 2 inches.
 - 3. Do not install spray polyurethane foam within 3 inches of heat emitting devices such as light fixtures and chimneys.
 - 4. Finished surface of foam insulation to be free of voids and embedded foreign objects.
 - 5. Remove masking materials and over spray from adjacent areas immediately after foam surface has hardened. Ensure cleaning methods do not damage work performed by other sections.
 - 6. Trim, as required, any excess thickness that would interfere with the application of cladding/covering system by other trades.
 - 7. Clean and restore surfaces soiled or damaged by work of the Section. Consult with section of work soiled before cleaning to ensure methods used will not damage the work.
 - 8. Do not permit adjacent work to be damaged by work of this Section. Damage to work of this Section caused by other Sections shall be repaired by this Section at the expense of the contractor / subcontractor causing the damage.

- B. For non-cavity wall locations, substrate surface shall be covered with insulation to a minimum thickness of 1.5 inches and an average of 2 inches for an average R-value of 10, unless otherwise noted.
- C. Provisions shall be made for ventilation to properly dry the insulation after application. In enclosed areas lacking natural ventilation, air circulation and ventilation is to be provided.
- D. Patching and repairing of sprayed insulation damaged by other trades shall be performed under this Section and paid for by the trade(s) causing the damage.
 - 1. Complete connections to other components or repair any gaps, holes or other damage using material.
- E. Repair or replace work that has not been successfully protected.
- F. Shield the spray polyurethane foam from interior exposure with one of the approved thermal barrier systems listed above.
- G. Use sprayed polyurethane foam sealant to fill voids in building envelope, including but not limited to roof openings, roof drain pans and bodies and penetrations around window, and storefront frames, and similar penetrations unless otherwise noted or included as work of Division 07 Section "Thermal Insulation".

3.4 FIELD QUALITY CONTROL

- A. **Installer Self-Inspection:** The installer shall conduct daily inspections in accordance with ULC S705.2 and record the results of these inspections on a Daily Work Record in accordance with ULC S705.2. These Daily Work Records shall be made available upon request.
- B. **Owner's Inspection and Testing:** Cooperate with Owner's testing agency. Allow access to work areas and staging. Notify Owner's testing agency in writing of schedule for Work of this Section to allow sufficient time for testing and inspection. Daily inspection and testing may be required. Do not cover Work of this Section until testing and inspection is accepted.

3.5 CLEANING

- A. After completion of the insulation work, equipment shall be removed and exposed wall and floor areas shall be left in a broom-clean condition.

END OF SECTION 072723

SECTION 072726 - FLUID-APPLIED MEMBRANE AIR BARRIERS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:
 - 1. Vapor-retarding, fluid-applied air barriers at exterior envelope infill areas.

1.3 DEFINITIONS

- A. Air-Barrier Material: A primary element that provides a continuous barrier to the movement of air.
- B. Air-Barrier Accessory: A transitional component of the air barrier that provides continuity.
- C. Air-Barrier Assembly: The collection of air-barrier materials and accessories applied to an opaque wall, including joints and junctions to abutting construction, to control air movement through the wall.

1.4 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site.
 - 1. Review air-barrier requirements and installation, special details, mockups, air-leakage and bond testing, air-barrier protection, and work scheduling that covers air barriers.

1.5 ACTION SUBMITTALS

- A. Product Data: For each type of product.
 - 1. Include manufacturer's written instructions for evaluating, preparing, and treating each substrate; technical data; dry film thickness; and tested physical and performance properties of products.
- B. Shop Drawings: For air-barrier assemblies.
 - 1. Show locations and extent of air-barrier materials, accessories, and assemblies specific to Project conditions.
 - 2. Include details for substrate joints and cracks, counterflashing strips, penetrations, inside and outside corners, terminations, and tie-ins with adjoining construction.
 - 3. Include details of interfaces with other materials that form part of air barrier.

1.6 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For Installer. Include list of ABAA-certified installers and supervisors employed by Installer, who work on Project.
- B. Product Certificates: From air-barrier manufacturer, certifying compatibility of air barriers and accessory materials with Project materials that connect to or that come in contact with the barrier.
- C. Product Test Reports: For each air-barrier assembly, for tests performed by a qualified testing agency.
- D. Field quality-control reports.

1.7 QUALITY ASSURANCE

- A. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by manufacturer.
 - 1. Installer shall be licensed by ABAA according to ABAA's Quality Assurance Program and shall employ ABAA-certified installers and supervisors on Project.
- B. Mockups: Build mockups to set quality standards for materials and execution and for preconstruction inspections.
 - 1. Build integrated mockups of exterior wall assembly, 150 sq. ft., incorporating backup wall construction, external cladding, window, storefront, door frame and sill, insulation, ties and other penetrations, and flashing to demonstrate surface preparation, crack and joint treatment, application of air barriers, and sealing of gaps, terminations, and penetrations of air-barrier assembly.
 - a. Coordinate construction of mockups to permit inspection and testing of air barrier before external insulation and cladding are installed.
 - b. Include junction with roofing membrane, building corner condition, and foundation wall intersection.
 - c. If Architect determines mockups do not comply with requirements, reconstruct mockups and apply air barrier until mockups are approved.
 - 2. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
 - 3. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.8 PRECONSTRUCTION INSPECTION

- A. Preconstruction Inspection Service: Owner will engage a qualified testing agency to perform preconstruction testing on field mockups.

- B. Mockup Inspection: Air-barrier assemblies shall comply with performance requirements indicated, as evidenced by reports based on mockup inspection by a qualified testing agency.
 - 1. Adhesion Testing: Mockups will be inspected for required air-barrier adhesion to substrate according to ASTM D4541.
 - 2. Notify Architect seven days in advance of the dates and times when mockups will be inspected.
 - 3. Refer to related envelop specification sections for inspection and mockup requirements.

1.9 DELIVERY, STORAGE, AND HANDLING

- A. Remove and replace liquid materials that cannot be applied within their stated shelf life.
- B. Protect stored materials from direct sunlight.

1.10 FIELD CONDITIONS

- A. Environmental Limitations: Apply air barrier within the range of ambient and substrate temperatures recommended in writing by air-barrier manufacturer.
 - 1. Protect substrates from environmental conditions that affect air-barrier performance.
 - 2. Do not apply air barrier to a damp or wet substrate or during snow, rain, fog, or mist.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Source Limitations: Obtain primary air-barrier materials and air-barrier accessories from single source from single manufacturer.
- B. VOC Content: 250 g/L or less.

2.2 PERFORMANCE REQUIREMENTS

- A. Air-Barrier Performance: Air-barrier assembly and seals with adjacent construction shall be capable of performing as a continuous air barrier and as a liquid-water drainage plane flashed to discharge to the exterior incidental condensation or water penetration. Air-barrier assemblies shall be capable of accommodating substrate movement and of sealing substrate expansion and control joints, construction material changes, penetrations, tie-ins to installed waterproofing, and transitions at perimeter conditions without deterioration and air leakage exceeding specified limits.
- B. Air-Barrier Assembly Air Leakage: Maximum 0.04 cfm/sq. ft. of surface area at 1.57 lbf/sq. ft., when tested according to ASTM E2357.

2.3 HIGH-BUILD AIR BARRIERS, VAPOR RETARDING

- A. High-Build, Vapor-Retarding Air Barrier: Modified bituminous or synthetic polymer membrane with an installed dry film thickness, according to manufacturer's written instructions, of 35 mils or thicker over smooth, void-free substrates.
1. Modified Bituminous Type:
 - a. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1) Carlisle Coatings & Waterproofing Inc.
 - 2) Henry Company.
 - 3) Prosoco.
 - 4) Tremco Incorporated – “Exoair 120” (BASIS OF DESIGN)
 2. Synthetic Polymer Type:
 - a. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1) Carlisle Coatings & Waterproofing Inc.
 - 2) Henry Company.
 - 3) Prosoco.
 - 4) Tremco Incorporated.
 3. Physical and Performance Properties:
 - a. Air Permeance: Maximum 0.004 cfm/sq. ft. of surface area at 1.57-lbf/sq. ft. pressure difference; ASTM E2178.
 - b. Vapor Permeance: Maximum 0.1 perm; ASTM E96/E96M, Desiccant Method.
 - c. Ultimate Elongation: Minimum 500 percent; ASTM D412, Die C.
 - d. Adhesion to Substrate: Minimum 16 lbf/sq. in. when tested according to ASTM D4541.
 - e. Fire Propagation Characteristics: Passes NFPA 285 testing as part of an approved assembly.
 - f. UV Resistance: Can be exposed to sunlight for 30 days according to manufacturer's written instructions.

2.4 ACCESSORY MATERIALS

- A. Requirement: Provide primers, transition strips, termination strips, joint reinforcing fabric and strips, joint sealants, counterflashing strips, flashing sheets and metal termination bars, termination mastic, substrate patching materials, adhesives, tapes, foam sealants, lap sealants, and other accessory materials that are recommended in writing by air-barrier manufacturer to produce a complete air-barrier assembly and that are compatible with primary air-barrier material and adjacent construction to which they may seal.
- B. Primer: Liquid primer recommended for substrate by air-barrier material manufacturer.
- C. Stainless-Steel Sheet: ASTM A240/A240M, Type 304, 0.0187 inch thick, and Series 300 stainless-steel fasteners.

- D. Preformed Silicone Extrusion: Manufacturer's standard system consisting of cured low-modulus silicone extrusion, sized to fit opening widths, with a single-component, neutral-curing, Class 100/50 (low-modulus) silicone sealant for bonding extrusions to substrates.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements and other conditions affecting performance of the Work.
 - 1. Verify that substrates are sound and free of oil, grease, dirt, excess mortar, or other contaminants.
 - 2. Verify that substrates have cured and aged for minimum time recommended in writing by air-barrier manufacturer.
 - 3. Verify that substrates are visibly dry and free of moisture. Test concrete substrates for capillary moisture by plastic sheet method according to ASTM D4263.
 - 4. Verify that masonry joints are flush and completely filled with mortar.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 SURFACE PREPARATION

- A. Clean, prepare, treat, fill, and seal substrate and joints and cracks in substrate according to manufacturer's written instructions and details. Provide clean, dust-free, and dry substrate for air-barrier application.
- B. Mask off adjoining surfaces not covered by air barrier to prevent spillage and overspray affecting other construction.
- C. Remove grease, oil, bitumen, form-release agents, paints, curing compounds, and other penetrating contaminants or film-forming coatings from concrete.
- D. Remove fins, ridges, mortar, and other projections and fill honeycomb, aggregate pockets, holes, and other voids in concrete with substrate-patching material.
- E. Remove excess mortar from masonry ties, shelf angles, and other obstructions.
- F. At changes in substrate plane, apply sealant or termination mastic beads at sharp corners and edges to form a smooth transition from one plane to another.
- G. Cover gaps in substrate plane and form a smooth transition from one substrate plane to another with stainless-steel sheet mechanically fastened to structural framing to provide continuous support for air barrier.
- H. Bridge isolation joints, expansion joints, and discontinuous wall-to-wall, deck-to-wall, and deck-to-deck joints with air-barrier accessory material that accommodates joint movement according to manufacturer's written instructions and details.
- I. Cover gaps in substrate plane with mechanically fastened stainless steel sheet to span gaps in substrate plane, and to make a smooth transition from one plane to the other including gaps at structural steel columns. Membrane shall be continuously supported by substrate on each side of the gap.

3.3 ACCESSORIES INSTALLATION

- A. Install accessory materials according to air-barrier manufacturer's written instructions and details to form a seal with adjacent construction and ensure continuity of air and water barrier.
 - 1. Coordinate the installation of air barrier with installation of roofing membrane and base flashing to ensure continuity of air barrier with roofing membrane.
 - 2. Install transition strip on roofing membrane or base flashing so that a minimum of 3 inches of coverage is achieved over each substrate.
 - 3. Unless manufacturer recommends in writing against priming, apply primer to substrates at required rate and allow it to dry.
 - 4. Apply primer to substrates at required rate and allow it to dry. Limit priming to areas that will be covered by air-barrier material on same day. Reprime areas exposed for more than 24 hours.
- B. Connect and seal exterior wall air-barrier material continuously to roofing-membrane air barrier, concrete below-grade structures, floor-to-floor construction, exterior glazing and window systems, glazed curtain-wall systems, storefront systems, exterior louvers, exterior door framing, and other construction used in exterior wall openings, using accessory materials.
- C. At end of each working day, seal top edge of strips and transition strips to substrate with termination mastic.
- D. Apply joint sealants forming part of air-barrier assembly within manufacturer's recommended application temperature ranges. Consult manufacturer when sealant cannot be applied within these temperature ranges.
- E. Wall Openings: Prime concealed, perimeter frame surfaces of windows, curtain walls, storefronts, and doors. Apply transition strip or preformed silicone extrusion so that a minimum of 3 inches of coverage is achieved over each substrate. Maintain 3 inches of full contact over firm bearing to perimeter frames, with not less than 1 inch of full contact.
 - 1. Transition Strip: Roll firmly to enhance adhesion.
 - 2. Preformed Silicone Extrusion: Set in full bed of silicone sealant applied to walls, frame, and air-barrier material.
- F. Fill gaps in perimeter frame surfaces of windows, curtain walls, storefronts, and doors, and miscellaneous penetrations of air-barrier material with foam sealant.
- G. Seal strips and transition strips around masonry reinforcing or ties and penetrations with termination mastic.
- H. Seal top of through-wall flashings to air barrier with an additional 6-inch-wide, transition strip.
- I. Seal exposed edges of strips at seams, cuts, penetrations, and terminations not concealed by metal counterflashings or ending in reglets with termination mastic.
- J. Repair punctures, voids, and deficient lapped seams in strips and transition strips. Slit and flatten fishmouths and blisters. Patch with transition strips extending 6 inches beyond repaired areas in strip direction.

3.4 PRIMARY AIR-BARRIER MATERIAL INSTALLATION

- A. Apply air-barrier material to form a seal with strips and transition strips and to achieve a continuous air barrier according to air-barrier manufacturer's written instructions and details. Apply air-barrier material within manufacturer's recommended application temperature ranges.
 - 1. Unless manufacturer recommends in writing against priming, apply primer to substrates at required rate and allow it to dry.
 - 2. Limit priming to areas that will be covered by air-barrier material on same day. Reprime areas exposed for more than 24 hours.
 - 3. Where multiple prime coats are needed to achieve required bond, allow adequate drying time between coats.
- B. High-Build Air Barriers: Apply continuous unbroken air-barrier material to substrates according to the following thickness. Apply air-barrier material in full contact around protrusions such as masonry ties.
 - 1. Vapor-Retarding, High-Build Air Barrier: Total dry film thickness as recommended in writing by manufacturer to comply with performance requirements, but not less than 40 mils, applied per manufacturers instructions.
- C. Do not cover air barrier until it has been inspected by testing agency.
- D. Correct deficiencies in or remove air barrier that does not comply with requirements; repair substrates and reapply air-barrier components.

3.5 FIELD QUALITY CONTROL

- A. ABAA Quality Assurance Program: Perform examinations, preparation, installation, testing, and inspections under ABAA's Quality Assurance Program.
- B. Testing Agency: Owner will engage a qualified testing agency to perform inspections.
- C. Inspections: Air-barrier materials, accessories, and installation are subject to inspection for compliance with requirements. Inspections may include the following:
 - 1. Continuity of air-barrier system has been achieved throughout the building envelope with no gaps or holes.
 - 2. Air-barrier dry film thickness.
 - 3. Continuous structural support of air-barrier system has been provided.
 - 4. Masonry and concrete surfaces are smooth, clean, and free of cavities, protrusions, and mortar droppings.
 - 5. Site conditions for application temperature and dryness of substrates have been maintained.
 - 6. Maximum exposure time of materials to UV deterioration has not been exceeded.
 - 7. Surfaces have been primed, if applicable.
 - 8. Laps in strips and transition strips have complied with minimum requirements and have been shingled in the correct direction (or mastic has been applied on exposed edges), with no fishmouths.
 - 9. Termination mastic has been applied on cut edges.
 - 10. Strips and transition strips have been firmly adhered to substrate.
 - 11. Compatible materials have been used.
 - 12. Transitions at changes in direction and structural support at gaps have been provided.
 - 13. Connections between assemblies (air-barrier and sealants) have complied with requirements for cleanliness, surface preparation and priming, structural support, integrity, and continuity of seal.

14. All penetrations have been sealed.
- D. Tests: As determined by testing agency:
- E. Air barriers will be considered defective if they do not pass tests and inspections.
1. Apply additional air-barrier material, according to manufacturer's written instructions, where inspection results indicate insufficient thickness.
 2. Remove and replace deficient air-barrier components for retesting as specified above.
- F. Repair damage to air barriers caused by testing; follow manufacturer's written instructions.
- G. Prepare test and inspection reports.

3.6 CLEANING AND PROTECTION

- A. Protect air-barrier system from damage during application and remainder of construction period, according to manufacturer's written instructions.
1. Protect air barrier from exposure to UV light and harmful weather exposure as recommended in writing by manufacturer. If exposed to these conditions for longer than recommended, remove and replace air barrier or install additional, full-thickness, air-barrier application after repairing and preparing the overexposed materials according to air-barrier manufacturer's written instructions.
 2. Protect air barrier from contact with incompatible materials and sealants not approved by air-barrier manufacturer.
- B. Clean spills, stains, and soiling from construction that would be exposed in the completed work using cleaning agents and procedures recommended in writing by manufacturer of affected construction.
- C. Remove masking materials after installation.

END OF SECTION 072726

SECTION 075423 - THERMOPLASTIC-POLYOLEFIN (TPO) ROOFING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:
 - 1. Mechanically fastened, thermoplastic polyolefin (TPO) roofing system.
 - 2. Substrate board.
 - 3. Cover Board
 - 4. Roof insulation.
 - 5. Walkways.

1.3 DEFINITIONS

- A. Roofing Terminology: Definitions in ASTM D1079 and glossary in NRCA's "The NRCA Roofing Manual: Membrane Roof Systems" apply to Work of this Section.

1.4 PREINSTALLATION MEETINGS

- A. Preliminary Roofing Conference: Before starting roof deck construction, conduct conference at Project Site
 - 1. Meet with Owner, Architect, Owner's insurer if applicable, testing and inspecting agency representative, roofing Installer, roofing system manufacturer's representative and installers whose work interfaces with or affects roofing, including installers of roof accessories and roof-mounted equipment.
 - 2. Review methods and procedures related to roofing installation, including manufacturer's written instructions.
 - 3. Review deck substrate requirements for conditions and finishes, including flatness and fastening.
 - 4. Review structural loading limitations of roof deck during and after roofing.
 - 5. Review base flashings, special roofing details, roof drainage, roof penetrations, equipment curbs, and condition of other construction that affects roofing system.
 - 6. Review roof observation and repair procedures after roofing installation.
- B. Pre-installation Roofing Conference: Conduct conference at Project Site.
 - 1. Meet with Owner, Architect, Owner's insurer if applicable, testing and inspecting agency representative, roofing Installer, roofing system manufacturer's representative and installers whose work interfaces with or affects roofing, including installers of roof accessories and roof-mounted equipment.

2. Review methods and procedures related to roofing installation, including manufacturer's written instructions.

1.5 ACTION SUBMITTALS

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

1.6 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For installer.
- B. Installer warranty shall be submitted for review by Owner and Architect.
- C. Manufacturer Certificates:
 1. Performance Requirement Certificate: Signed by roof membrane manufacturer, certifying that roofing system complies with requirements specified in "Performance Requirements" Article.
 2. Special Warranty Certificate: Signed by roof membrane manufacturer, certifying that all materials supplied under this Section are acceptable for special warranty.
- D. Sample Warranties: For manufacturer's special warranties.

1.7 CLOSEOUT SUBMITTALS

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

1.8 QUALITY ASSURANCE

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

1.9 DELIVERY, STORAGE, AND HANDLING

- A. Deliver roofing materials to Project site in original containers with seals unbroken and labeled with manufacturer's name, product brand name and type, date of manufacture, approval or listing agency markings, and directions for storing and mixing with other components.
- B. Store liquid materials in their original undamaged containers in a clean, dry, protected location and within the temperature range required by roofing system manufacturer. Protect stored liquid material from direct sunlight.
- C. Protect roof insulation materials from physical damage and from deterioration by sunlight, moisture, soiling, and other sources. Store in a dry location. Comply with insulation manufacturer's written instructions for handling, storing, and protecting during installation.
- D. Handle and store roofing materials, and place equipment in a manner to avoid permanent deflection of deck.

1.10 FIELD CONDITIONS

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

1.11 WARRANTY

- A. Special Warranty: Manufacturer agrees to repair or replace components of roofing system that fail in materials or workmanship within specified warranty period.
 - 1. Special warranty includes roof membrane, base flashings, roof insulation, fasteners, cover boards, substrate board and other components of roofing system.
 - 2. Warranty Period: 20 years from date of Substantial Completion.
 - 3. Warranty Period: Refer to Alternates section for additional Warranty coverage to 30 years.
- B. Special Project Warranty: Submit roofing Installer's warranty, signed by Installer, covering the Work of this Section, including all components of roofing system for the following warranty period:
 - 1. Warranty Period: Two years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. General Performance: Installed roofing system and flashings shall withstand specified uplift pressures, thermally induced movement, and exposure to weather without failure due to defective manufacture, fabrication, installation, or other defects in construction. Roof system and flashings shall remain watertight.
- B. Material Compatibility: Roofing materials shall be compatible with one another and adjacent materials under conditions of service and application required, as demonstrated by roof membrane manufacturer based on testing and field experience.
- C. FM Approvals' RoofNav Listing: Roof membrane, base flashings, and component materials shall comply with requirements in FM Approvals 4450 or FM Approvals 4470 as part of a roofing system, and shall be listed in FM Approvals' RoofNav for Class 1 or noncombustible construction, as applicable. Identify materials with FM Approvals Certification markings.
 - 1. Fire/Windstorm Classification: Class 1A-90.
 - 2. Hail-Resistance Rating: FM Global Property Loss Prevention Data Sheet 1-34 MH.
- D. SPRI's Directory of Roof Assemblies Listing: Roof membrane, base flashings, and component materials shall comply with requirements in FM Approvals 4450 or FM Approvals 4470 as part of a roofing system, and shall be listed in SPRI's Directory of Roof Assemblies for roof assembly identical for that specified for this Project.
 - 1. Wind Uplift Load Capacity: 75 psf.
- E. Exterior Fire-Test Exposure: ASTM E108 or UL 790, Class B for application and roof slopes indicated; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

2.2 THERMOPLASTIC POLYOLEFIN (TPO) ROOFING

- A. TPO Sheet: ASTM D6878/D6878M, scrim-reinforced, TPO sheet.
 - 1. Manufacturers:
 - a. Carlisle Syntec – SureWeld
 - b. Firestone – Ultraply TPO (Basis of Design)
 - 2. Obtain components for roofing system from roof manufacturer.
 - 3. Thickness: 60 mils nominal.
 - a. Refer to Alternate bid requirements that may affect membrane thickness.
 - 4. Polyisocyanurate insulation boards in multiple layers as recommended by roofing manufacturer.
 - 5. Cover Board / Substrate Board: HD Polyiso board as recommended by manufacturer for existing substrate conditions
 - 6. Exposed Face Color: Selection by Architect from manufacturer's full range of available colors.

2.3 AUXILIARY ROOFING MATERIALS

- A. General: Auxiliary materials recommended by roofing system manufacturer for intended use and compatible with other roofing components.
- B. Sheet Flashing: Manufacturer's standard unreinforced TPO sheet flashing, thickness recommended by manufacturer, of same color as TPO sheet.
- C. Metal roof edge metal provided and installed by roofing contractor of materials acceptable to roofing manufacturer as part of a total warranted system.
 - 1. Metal roof edge materials and anchorage shall comply with ANSI-SPRI ES1 wind uplift requirements.
 - 2. Metal roof edge materials shall be compatible with or separated from existing metal flashings and metal panel materials that are to remain.
- D. Prefabricated Pipe Flashings: As may be recommended by roof membrane manufacturer.
- E. Slip Sheet: Manufacturer's standard, of thickness required for application.
- F. Metal Termination Bars: Manufacturer's standard, predrilled stainless steel or aluminum bars, approximately 1 by 1/8 inch (25 by 3 mm) thick; with anchors.
 - 1. Anchor spacing shall be determined by roofing manufacturer to meet total system warranty requirements.
- G. Fasteners: Factory-coated steel fasteners and metal or plastic plates designed for fastening roofing components to substrate, and acceptable to roofing system manufacturer.

2.4 ROOF INSULATION

- A. General: Preformed roof insulation boards approved by TPO roof membrane manufacturer.
- B. Polyisocyanurate Board Insulation: ASTM C1289, Type II, Class 2, Grade 2, felt or glass-fiber mat facer on both major surfaces.
 - 1. Compressive Strength: 20 psi. minimum.
 - 2. Thickness:
 - a. As indicated on drawings and recommended by manufacturer.

2.5 INSULATION ACCESSORIES

- A. General: Roof insulation accessories recommended by insulation manufacturer for intended use and compatibility with other roofing system components.
- B. Fasteners: Factory-coated steel fasteners with metal or plastic plates complying with corrosion-resistance provisions in FM Approvals 4470, designed for fastening roof insulation to substrate, and acceptable to roofing system manufacturer.

- C. Cover Board – Substrate Board: ASTM C1289 Type II, Class 4, Grade 1, 1/2-inch- thick polyisocyanurate, with a minimum compressive strength of 80 psi.

2.6 WALKWAYS

- A. Flexible Walkways: Factory-formed, nonporous, heavy-duty, slip-resisting, surface-textured walkway pads or rolls approximately 3/16 inch thick and acceptable to roofing system manufacturer.
 - 1. Size: As standard with manufacturer
 - 2. Color: Contrasting with roof membrane.

PART 3 - EXECUTION

3.1 EXAMINATION

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

3.2 PREPARATION

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

3.3 INSTALLATION OF ROOFING, GENERAL

- A. Install roofing system according to roofing system manufacturer's written instructions, for listed roof assembly requirements.
- B. Complete terminations and base flashings and provide temporary seals to prevent water from entering completed sections of roofing system at end of workday or when rain is forecast. Remove and discard temporary seals before beginning Work on adjoining roofing.

3.4 INSTALLATION OF SUBSTRATE BOARD

- A. Install substrate board with long joints in continuous straight lines, with end joints staggered not less than 24 inches in adjacent rows.

1. Tightly butt substrate boards together.
2. Cut substrate board to fit tight around penetrations and projections, and to fit tight to intersecting sloping roof decks.
3. Fasten substrate board to top flanges of steel deck according to manufacturer recommendations.

3.5 INSTALLATION OF INSULATION

- A. Coordinate installing roofing system components so insulation is not exposed to precipitation or left exposed at end of workday.
- B. Comply with roofing system and roof insulation manufacturer's written instructions for installing roof insulation.

3.6 INSTALLATION OF COVER BOARDS

- A. Install cover boards over insulation with long joints in continuous straight lines with end joints staggered between rows. Offset joints of insulation below a minimum of 6 inches in each direction.
 1. Trim cover board neatly to fit around penetrations and projections, and to fit tight to intersecting sloping roof decks.
 2. At internal roof drains, conform to slope of drain sump.
 - a. Trim cover board so that water flow is unrestricted.
 3. Cut and fit cover board tight to nailers, projections, and penetrations.

3.7 INSTALLATION OF MECHANICALLY FASTENED ROOF MEMBRANE

- A. Mechanically fasten roof membrane over area to receive roofing according to roofing system manufacturer's written instructions.
- B. Unroll roof membrane and allow to relax before installing.
- C. Accurately align roof membrane, and maintain uniform side and end laps of minimum dimensions required by manufacturer. Stagger end laps.
- D. Mechanically fasten or adhere roof membrane securely at terminations, penetrations, and perimeter of roofing.
- E. Apply roof membrane with side laps shingled with slope of roof deck where possible.
- F. Seams: Clean seam areas, overlap roof membrane, and hot-air weld side and end laps of roof membrane and sheet flashings to ensure a watertight seam installation.
 1. Test lap edges with probe to verify seam weld continuity. Apply lap sealant to seal cut edges of roof membrane and flashing sheet.
 2. Verify field strength of seams a minimum of twice daily, and repair seam sample areas.
 3. Repair tears, voids, and lapped seams in roof membrane that do not comply with requirements.

- G. Spread sealant bed over deck-drain flange at roof drains, and securely seal roof membrane in place with clamping ring.

3.8 INSTALLATION OF BASE FLASHING

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

3.9 INSTALLATION OF WALKWAYS

- A. Flexible Walkways:
 - 1. Install flexible walkways at locations below.
 - a. Perimeter of each rooftop unit.
 - b. Between each rooftop unit location, creating a continuous path connecting rooftop unit locations.
 - c. Between each roof hatch and rooftop unit location or path connecting rooftop unit locations.
 - d. Top and bottom of each roof access ladder.
 - e. Locations indicated on Drawings.
 - 2. Provide 6-inch clearance between adjoining pads.
 - 3. Heat weld to substrate or adhere walkway products to substrate with compatible adhesive according to roofing system manufacturer's written instructions.

3.10 FIELD QUALITY CONTROL

- A. Owner will engage a qualified testing agency to perform the following tests:
 - 1. Infrared Thermography: Testing agency shall survey entire roof area using infrared color thermography according to ASTM C1153.
 - a. Perform tests before overlying construction is placed.
 - b. Testing agency shall prepare survey report of initial scan indicating locations of entrapped moisture, if any.
- B. Final Roof Inspection: Arrange for roofing system manufacturer's technical personnel to inspect roofing installation on completion, in presence of Architect, and to prepare inspection report.

- C. Repair or remove and replace components of roofing system where inspections indicate that they do not comply with specified requirements.
- D. Additional testing and inspecting, at Contractor's expense, will be performed to determine if replaced or additional work complies with specified requirements.

3.11 PROTECTING AND CLEANING

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

3.12 ROOFING INSTALLER'S WARRANTY

- A. Installer shall submit installation warranty as specified above, for review by Owner and Architect.

END OF SECTION 075423

SECTION 077100 - ROOF SPECIALTIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:

- 1. Copings /Roof-edge specialties / Fascia
- 2. Reglets and counterflashings.

- B. Preinstallation Conference: Conduct conference at Project Site.

- 1. Meet with Owner, Architect, Owner's insurer if applicable, roofing-system testing and inspecting agency representative, roofing Installer, roofing-system manufacturer's representative, Installer, structural-support Installer, and installers whose work interfaces with or affects roof specialties, including installers of roofing materials and accessories.
- 2. Examine substrate conditions for compliance with requirements, including flatness and attachment to structural members.
- 3. Review special roof details, roof drainage, and condition of other construction that will affect roof specialties.

1.3 ACTION SUBMITTALS

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

- 1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes.

- B. Shop Drawings: For roof specialties.

- 1. Include plans, elevations, expansion-joint locations, keyed details, and attachments to other work. Distinguish between plant- and field-assembled work.
- 2. Include details for expansion and contraction; locations of expansion joints, including direction of expansion and contraction.
- 3. Indicate profile and pattern of seams and layout of fasteners, cleats, clips, and other attachments.
- 4. Detail termination points and assemblies, including fixed points.
- 5. Include details of special conditions.

- C. Samples: For each type of roof specialty and for each color and texture specified.

- D. Samples for Initial Selection: For each type of roof specialty indicated with factory-applied color finishes.

E. Samples for Verification:

1. Include Samples of each type of roof specialty to verify finish and color selection, in manufacturer's standard sizes.

1.4 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For manufacturer.
- B. Product Certificates: For each type of roof specialty.
- C. Product Test Reports: For copings and roof edge flashings for tests performed by a qualified testing agency.
- D. Sample Warranty: For manufacturer's special warranty.

1.5 CLOSEOUT SUBMITTALS

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

1.6 QUALITY ASSURANCE

- A. Mockups: Build mockups to verify selections made under Sample submittals, to demonstrate aesthetic effects, and set quality standards for fabrication and installation.
 1. Build mockup of typical roof edge, including fascia, gutter, roof edge flashing, including membrane roof termination and interfaces with roof specialties 10 feet long.
 2. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
 3. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Do not store roof specialties in contact with other materials that might cause staining, denting, or other surface damage. Store roof specialties away from uncured concrete and masonry.
- B. Protect strippable protective covering on roof specialties from exposure to sunlight and high humidity, except to extent necessary for the period of roof-specialty installation.

1.8 FIELD CONDITIONS

- A. Field Measurements: Verify profiles and tolerances of roof-specialty substrates by field measurements before fabrication, and indicate measurements on Shop Drawings.
- B. Coordination: Coordinate roof specialties with flashing, trim, and construction of parapets, roof deck, roof and wall panels, and other adjoining work to provide a leakproof, secure, and noncorrosive installation.

1.9 WARRANTY

- A. Roofing-System Warranty: Roof specialties are included in warranty provisions in Section 075423.
- B. Special Warranty on Painted Finishes: Manufacturer agrees to repair finish or replace roof specialties that show evidence of deterioration of factory-applied finishes within specified warranty period.
 - 1. Fluoropolymer Finish: Deterioration includes, but is not limited to, the following:
 - a. Color fading more than 5 Delta E units when tested according to ASTM D2244.
 - b. Chalking in excess of a No. 8 rating when tested according to ASTM D4214.
 - c. Cracking, checking, peeling, or failure of paint to adhere to bare metal.
 - 2. Finish Warranty Period: 20 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. General Performance: Roof specialties shall withstand exposure to weather and resist thermally induced movement without failure, rattling, leaking, or fastener disengagement due to defective manufacture, fabrication, installation, or other defects in construction.
- B. SPRI Wind Design Standard: Manufacture and install copings and roof edge specialties tested according to SPRI ES-1 and capable of resisting the following design pressures:
 - 1. Design Pressure: As indicated on Drawings
- C. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes to prevent buckling, opening of joints, hole elongation, overstressing of components, failure of joint sealants, failure of connections, and other detrimental effects. Provide clips that resist rotation and avoid shear stress as a result of thermal movements. Base calculations on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.
 - 1. Temperature Change (Range): 120 deg F, ambient; 180 deg F material surfaces.

2.2 COPINGS

- A. Metal Copings: Manufactured coping system consisting of metal coping cap in section lengths not exceeding 12 feet, concealed anchorage; with corner units, end cap units, and concealed splice plates with finish matching coping caps.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Architectural Products Company.
 - b. ATAS International, Inc.
 - c. Metal-Era, Inc.
 - d. PAC-CLAD; Petersen Aluminum Corporation; a Carlisle company.
 - e. SAF (Southern Aluminum Finishing Company, Inc.).

2. Coping-Cap Attachment Method: Snap on face leg hooked to continuous cleat with back leg fastener exposed], fabricated from coping-cap material.
 - a. Snap-on Coping Anchor Plates: Concealed, galvanized-steel sheet, 12 inches wide, with integral cleats.
 - b. Face-Leg Cleats: Concealed, continuous galvanized steel or stainless steel.

2.3 ROOF-EDGE SPECIALTIES

- A. Roof-Edge Coping / Fascia: Manufactured, two-piece, roof-edge fascia consisting of snap-on metal fascia cover in section lengths not exceeding 12 feet and a continuous metal receiver with integral drip-edge cleat to engage fascia cover and secure single-ply roof membrane. Provide matching corner units.
 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Berridge Manufacturing Company.
 - b. Drexel Metals.
 - c. Exceptional Metals.
 - d. Fabral.
 - e. Metal-Era, Inc.
 - f. Perimeter Systems; a division of SAF.
 2. Formed Aluminum Sheet Fascia Covers: Aluminum sheet, .063 inch.
 - a. Surface: Smooth finish.
 - b. Finish: Custom color matched 2-coate fluoropolymer coating.
 - c. Color: Match Architect's sample.
 3. Corners: Factory mitered and continuously welded.
 4. Splice Plates: Concealed of same material, finish, and shape as fascia cover.

2.4 ROOF GUTTER SYSTEMS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 1. Architectural Products Company.
 2. ATAS International, Inc.
 3. Berger Building Products, Inc.
 4. Castle Metal Products.
 5. Cheney Flashing Company.
 6. CopperCraft by FABRAL.
 7. Drexel Metals.
 8. Exceptional Metals.
 9. Merchant and Evans.
 10. Metal-Era, Inc.
 11. OMG, Inc.
 12. Perimeter Systems; a division of SAF.
 13. SAF (Southern Aluminum Finishing Company, Inc.).

- B. Gutters: Manufactured in uniform section lengths not exceeding 12 feet with matching corner units, ends, outlet tubes, and other accessories. Elevate back edge at least 1 inch above front edge. Furnish flat-stock gutter straps, gutter brackets, expansion joints, and expansion-joint covers fabricated from same metal as gutters.
1. Aluminum Sheet: .063 inch thickness
 2. Gutter Profile: As indicated according to SMACNA's "Architectural Sheet Metal Manual."
 3. Gutter Accessories: Downspout and end cap configurations as detailed, for connection to piped stormwater system.

2.5 REGLETS AND COUNTERFLASHINGS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Berridge Manufacturing Company.
 2. Castle Metal Products.
 3. Cheney Flashing Company.
 4. Drexel Metals.
 5. Exceptional Metals.
 6. Fry Reglet Corporation.
 7. Heckmann Building Products, Inc.
 8. Keystone Flashing Company, Inc.
 9. Metal-Era, Inc.
 10. OMG, Inc.
- B. Reglets: Manufactured units formed to provide secure interlocking of separate reglet and counterflashing pieces, from the following exposed metal:
1. Formed Aluminum: .050 inch thick.
 2. Surface-Mounted Type: Provide reglets with slotted holes for fastening to substrate, with neoprene or other suitable weatherproofing washers, and with channel for sealant at top edge.
 3. Masonry Type, Embedded: Provide reglets with offset top flange for embedment in masonry mortar joint.
- C. Counterflashings: Manufactured units of heights to overlap top edges of base flashings by 4 inches and in lengths not exceeding 12 feet designed to snap into reglets and compress against base flashings with joints lapped, from the following exposed metal:
1. Formed Aluminum: .032 inch thick.

2.6 MATERIALS

- A. Aluminum Sheet: ASTM B209, alloy as standard with manufacturer for finish required, with temper to suit forming operations and performance required.
- B. Aluminum Extrusions: ASTM B221, alloy and temper recommended by manufacturer for type of use and finish indicated, finished as follows:

2.7 UNDERLAYMENT MATERIALS

- A. Self-Adhering, High-Temperature Sheet: Minimum 30 to 40 mils thick, consisting of slip-resisting polyethylene-film top surface laminated to layer of butyl or SBS-modified asphalt adhesive, with release-paper backing; cold applied. Provide primer when recommended by underlayment manufacturer.
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Carlisle WIP Products; a brand of Carlisle Construction Materials.
 - b. Henry Company.
 - c. Owens Corning.
 - d. Protecto Wrap Company.
 2. Thermal Stability: ASTM D1970/D1970M; stable after testing at 240 deg F.
 3. Low-Temperature Flexibility: ASTM D1970/D1970M; passes after testing at minus 20 deg F.

2.8 MISCELLANEOUS MATERIALS

- A. Fasteners: Manufacturer's recommended fasteners, suitable for application and designed to meet performance requirements. Furnish the following unless otherwise indicated:
1. No exposed fasteners.
- B. Elastomeric Sealant: ASTM C920, elastomeric silicone polymer sealant of type, grade, class, and use classifications required by roofing-specialty manufacturer for each application.

2.9 FINISHES

- A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
- B. Protect mechanical and painted finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.
- C. Appearance of Finished Work: Noticeable variations in same piece are unacceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.
- D. Coil-Coated Aluminum Sheet Finishes:
1. High-Performance Organic Finish: Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
 - a. Two-Coat Fluoropolymer: AAMA 2605. Fluoropolymer finish containing not less than 70 percent polyvinylidene fluoride (PVDF) resin by weight in color coat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
 - b. Concealed Surface Finish: Apply pretreatment and manufacturer's standard acrylic or polyester backer finish consisting of prime coat and wash coat with a minimum total dry film thickness of 0.5 mil.

2. Clear Anodic Finish: AAMA 611, AA-M12C22A41, Class I, 0.018 mm or thicker.
3. Color Anodic Finish: AAMA 611, AA-M12C22A42/A44, Class I, 0.018 mm or thicker.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, to verify actual locations, dimensions, and other conditions affecting performance of the Work.
- B. Examine walls, roof edges, and parapets for suitable conditions for roof specialties.
- C. Verify that substrate is sound, dry, smooth, clean, sloped for drainage where applicable, and securely anchored.
- D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION OF UNDERLAYMENT

- A. Self-Adhering Sheet Underlayment: Apply primer if required by manufacturer. Comply with temperature restrictions of underlayment manufacturer for installation. Apply wrinkle free, in shingle fashion to shed water, and with end laps of not less than 6 inches staggered 24 inches between courses. Overlap side edges not less than 3-1/2 inches. Roll laps with roller. Cover underlayment within 14 days.

3.3 INSTALLATION, GENERAL

- A. Install roof specialties according to manufacturer's written instructions. Anchor roof specialties securely in place, with provisions for thermal and structural movement. Use fasteners, solder, protective coatings, separators, underlayments, sealants, and other miscellaneous items as required to complete roof-specialty systems.
- B. Metal Protection: Protect metals against galvanic action by separating dissimilar metals from contact with each other or with corrosive substrates by painting contact surfaces with bituminous coating or by other permanent separation as recommended by manufacturer.
- C. Expansion Provisions: Allow for thermal expansion of exposed roof specialties.
- D. Seal concealed joints with butyl sealant as required by roofing-specialty manufacturer.
- E. Seal joints as required for weathertight construction. Place sealant to be completely concealed in joint. Do not install sealants at temperatures below 40 deg F.
- F. Soldered Joints: Clean surfaces to be soldered, removing oils and foreign matter. Pre-tin edges of sheets to be soldered to a width of 1-1/2 inches; however, reduce pre-tinning where pre-tinned surface would show in completed Work. Tin edges of uncoated copper sheets using solder for copper. Do not use torches for soldering. Heat surfaces to receive solder and flow solder into joint. Fill joint completely. Completely remove flux and spatter from exposed surfaces.

3.4 INSTALLATION OF COPINGS / FASCIA / ROOF-EDGE SPECIALTIES

- A. Install cleats, anchor plates, and other anchoring and attachment accessories and devices with concealed fasteners.
- B. Anchor copings with manufacturer's required devices, fasteners, and fastener spacing to meet performance requirements.

3.5 INSTALLATION OF GUTTER SYSTEMS

- A. Install components of gutter system according to manufacturer's written instructions. Coordinate installation of roof perimeter flashing with installation of roof-edge drainage system.

3.6 INSTALLATION OF REGLETS AND COUNTERFLASHINGS

- A. Coordinate installation of reglets and counterflashings with installation of base flashings.
- B. Surface-Mounted Reglets: Install reglets to receive flashings where flashing without embedded reglets is indicated on Drawings. Install at height so that inserted counterflashings overlap 4 inches over top edge of base flashings.
- C. Counterflashings: Insert counterflashings into reglets or other indicated receivers; ensure that counterflashings overlap 4 inches over top edge of base flashings. Lap counterflashing joints a minimum of 4 inches and bed with butyl sealant. Fit counterflashings tightly to base flashings.

3.7 CLEANING AND PROTECTION

- A. Clean exposed metal surfaces of substances that interfere with uniform oxidation and weathering.
- B. Clean and neutralize flux materials. Clean off excess solder and sealants.
- C. Remove temporary protective coverings and strippable films as roof specialties are installed. On completion of installation, clean finished surfaces, including removing unused fasteners, metal filings, pop rivet stems, and pieces of flashing. Maintain roof specialties in a clean condition during construction.
- D. Replace roof specialties that have been damaged or that cannot be successfully repaired by finish touchup or similar minor repair procedures.

END OF SECTION 077100

SECTION 079200 - JOINT SEALANTS

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes sealants for the following applications, including those specified by reference to this Section:
- B. This Section includes sealants for the following applications:
 - 1. Exterior joints in the following vertical surfaces and nontraffic horizontal surfaces:
 - a. Control and expansion joints in unit masonry.
 - b. Joints between different materials listed above.
 - c. Perimeter joints between materials listed above and frames of doors and windows.

1.2 PERFORMANCE REQUIREMENTS

- A. Provide joint sealants for interior applications that establish and maintain airtight and water-resistant continuous joint seals without staining or deteriorating joint substrates.

1.3 SUBMITTALS

- A. Product Data: For each joint-sealant product indicated.
- B. Samples for Initial Selection: Manufacturer's color charts consisting of strips of cured sealants showing the full range of colors available for each product exposed to view.
- C. Warranties: Special warranties specified in this Section.

1.4 QUALITY ASSURANCE

- A. Installer Qualifications: Manufacturer's authorized Installer who is approved or licensed for installation of elastomeric sealants required for this Project.
- B. Source Limitations: Obtain each type of joint sealant through one source from a single manufacturer.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Store and handle materials in compliance with manufacturer's written instructions to prevent their deterioration or damage due to moisture, high or low temperatures, contaminants, or other causes.

1.6 PROJECT CONDITIONS

- A. Environmental Limitations: Do not proceed with installation of joint sealants under the following conditions:
 - 1. When ambient and substrate temperature conditions are outside limits permitted by joint sealant manufacturer.

1.7 WARRANTY

- A. General Warranty: Special warranties specified in this Article shall not deprive Owner of other rights Owner may have under other provisions of the Contract Documents and shall be in addition to, and run concurrent with, other warranties made by Contractor under requirements of the Contract Documents.
- B. Special Manufacturer's Warranty: Written warranty, signed by elastomeric sealant manufacturer agreeing to furnish elastomeric joint sealants to repair or replace those that do not comply with performance and other requirements specified in this Section within specified warranty period.
 - 1. Warranty Period: 20 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PRODUCTS AND MANUFACTURERS

- A. Products: Subject to compliance with requirements, provide one of the products indicated for each type in the sealant schedules at the end of Part 3.

2.2 MATERIALS, GENERAL

- A. Compatibility: Provide joint sealants, backings, and other related materials that are compatible with one another and with joint substrates under conditions of service and application, as demonstrated by sealant manufacturer based on testing and field experience.
- B. Colors of Exposed Joint Sealants: As selected by Architect from manufacturer's full range for this characteristic.

2.3 LATEX JOINT SEALANTS

- A. Latex Sealant Standard: Comply with ASTM C 834 for each product of this description indicated in the Latex Joint-Sealant Schedule at the end of Part 3.

2.4 SILICONE SEALANTS

- A. Silicone Sealants: Comply with ASTM C920 Type S.

2.5 JOINT-SEALANT BACKING

- A. General: Provide sealant backings of material and type that are nonstaining; are compatible with joint substrates, sealants, primers, and other joint fillers; and are approved for applications indicated by sealant manufacturer based on field experience and laboratory testing.
- B. Cylindrical Sealant Backings: ASTM C 1330, of type indicated below and of size and density to control sealant depth and otherwise contribute to producing optimum sealant performance:
 - 1. Type C: Closed-cell material with a surface skin.
 - 2. Type B: Bicellular material with a surface skin.
 - 3. Type: Any material indicated above.
- C. Elastomeric Tubing Sealant Backings: Neoprene, butyl, EPDM, or silicone tubing complying with ASTM D 1056, nonabsorbent to water and gas, and capable of remaining resilient at temperatures down to minus 26 deg F (minus 32 deg C). Provide products with low compression set and of size and shape to provide a secondary seal, to control sealant depth, and otherwise contribute to optimum sealant performance.
- D. Bond-Breaker Tape: Polyethylene tape or other plastic tape recommended by sealant manufacturer for preventing sealant from adhering to rigid, inflexible joint-filler materials or joint surfaces at back of joint where such adhesion would result in sealant failure. Provide self-adhesive tape where applicable.

2.6 MISCELLANEOUS MATERIALS

- A. Primer: Material recommended by joint sealant manufacturer where required for adhesion of sealant to joint substrates indicated, as determined from preconstruction joint-sealant-substrate tests and field tests.
- B. Cleaners for Nonporous Surfaces: Chemical cleaners acceptable to manufacturers of sealants and sealant backing materials, free of oily residues or other substances capable of staining or harming joint substrates and adjacent nonporous surfaces in any way, and formulated to promote optimum adhesion of sealants with joint substrates.
- C. Masking Tape: Nonstaining, nonabsorbent material compatible with joint sealants and surfaces adjacent to joints.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine joints indicated to receive joint sealants, with Installer present, for compliance with requirements for joint configuration, installation tolerances, and other conditions affecting joint-sealant performance.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Surface Cleaning of Joints: Clean out joints immediately before installing joint sealants to comply with joint sealant manufacturer's written instructions.

- B. Joint Priming: Prime joint substrates where recommended in writing by joint sealant.
- C. Masking Tape: Use masking tape where required to prevent contact of sealant with adjoining surfaces that otherwise would be permanently stained or damaged by such contact or by cleaning methods required to remove sealant smears. Remove tape immediately after tooling without disturbing joint seal.

3.3 INSTALLATION OF JOINT SEALANTS

- A. General: Comply with joint sealant manufacturer's written installation instructions for products and applications indicated, unless more stringent requirements apply.
- B. Sealant Installation Standard: Comply with recommendations of ASTM C 1193 for use of joint sealants as applicable to materials, applications, and conditions indicated.
- C. Install sealant backings of type indicated to support sealants during application and at position required to produce cross-sectional shapes and depths of installed sealants relative to joint widths that allow optimum sealant movement capability.
- D. Install bond-breaker tape behind sealants where sealant backings are not used between sealants and back of joints.

3.4 CLEANING

- A. Clean off excess sealants or sealant smears adjacent to joints as the Work progresses by methods and with cleaning materials approved in writing by manufacturers of joint sealants and of products in which joints occur.

3.5 PROTECTION

- A. Protect joint sealants during and after curing period from contact with contaminating substances and from damage resulting from construction operations or other causes so sealants are without deterioration or damage at time of Substantial Completion. If, despite such protection, damage or deterioration occurs, cut out and remove damaged or deteriorated joint sealants immediately so installations with repaired areas are indistinguishable from the original work.

3.6 ELASTOMERIC JOINT-SEALANT SCHEDULE

- A. Low-Modulus Nonacid-Curing Silicone Sealant: Where joint sealants of this type are required, provide products complying with the following:
 - 1. Products: Available products include the following:
 - a. 790; Dow Corning.
 - b. Silpruf; LM GE Silicones.
 - c. UltraPruf SCS2300; GE Silicones.
 - d. 864; Pecora Corporation.
 - 2. Type and Grade: S and NS.
 - 3. Class: 25.

4. Additional Movement Capability: 50 percent movement in extension and 50 percent movement in compression for a total of 100 percent movement.
- B. Medium-Modulus Neutral-Curing Silicone Sealant: Where joint sealants of this type are required, provide products complying with the following:
1. Products: Provide one of the following:
 - a. 756; Dow Corning.
 - b. Silglaze II; GE Silicones.
 - c. 895; Pecora Corporation.
 2. Type and Grade: S (single component) and NS (nonsag).
 3. Class: 25.
 4. Additional Movement Capability: 50 percent movement in extension and 50 percent movement in compression for a total of 100 percent movement.
 5. Uses Related to Exposure: NT (nontraffic).
 6. Uses Related to Joint Substrates: M, G, A, and, as applicable to joint substrates indicated, O.
 - a. Use O Joint Substrates: Coated glass, color anodic aluminum, aluminum coated with a high-performance coating, galvanized steel, brick, and precast concrete.

3.7 LATEX JOINT-SEALANT SCHEDULE

1. Products: Available products include the following:
 - a. AC-20; Pecora Corporation.
 - b. Sonolac; Sonneborn Building Products Div., ChemRex, Inc.

END OF SECTION 079200

DIVISION

08

OPENINGS

SECTION 081113 - HOLLOW METAL DOORS AND FRAMES

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Standard hollow metal doors and frames.

1.2 DEFINITIONS

- A. Minimum Thickness: Minimum thickness of base metal without coatings.
- B. Standard Hollow Metal Work: Hollow metal work fabricated according to ANSI/SDI A250.8.

1.3 SUBMITTALS

- A. Product Data: For each type of product indicated. Include construction details, material descriptions, core descriptions.
- B. Shop Drawings: Include the following:
 - 1. Elevations of each door design.
- C. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for each type of hollow metal door and frame assembly.

1.4 QUALITY ASSURANCE

- A. Source Limitations: Obtain hollow metal work from single source from single manufacturer.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Deliver hollow metal work palletized, wrapped, or crated to provide protection during transit and Project-site storage. Do not use non-vented plastic.
- B. Deliver welded frames with two removable spreader bars across bottom of frames, tack welded to jambs and mullions.

1.6 PROJECT CONDITIONS

- A. Field Measurements: Verify actual dimensions of openings by field measurements before fabrication.

1.7 COORDINATION

- A. Coordinate installation of anchorages for hollow metal frames. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors. Deliver such items to Project site in time for installation.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Amweld Building Products, LLC.
 - 2. Benchmark; a division of Therma-Tru Corporation.
 - 3. Ceco Door Products; an Assa Abloy Group company.
 - 4. Curries Company; an Assa Abloy Group company.
 - 5. Karpen Steel Custom Doors & Frames.
 - 6. Kewanee Corporation (The).
 - 7. Pioneer Industries, Inc.
 - 8. Steelcraft; an Ingersoll-Rand company.

2.2 MATERIALS

- A. Cold-Rolled Steel Sheet: ASTM A 1008/A 1008M, Commercial Steel (CS), Type B; suitable for exposed applications.
- B. Hot-Rolled Steel Sheet: ASTM A 1011/A 1011M, Commercial Steel (CS), Type B; free of scale, pitting, or surface defects; pickled and oiled.
- C. Metallic-Coated Steel Sheet: ASTM A 653/A 653M, Commercial Steel (CS), Type B; with minimum A60 galvanealed metallic coating.
- D. Frame Anchors: ASTM A 591/A 591M, Commercial Steel (CS), 40Z (12G) coating designation; mill phosphatized.
 - 1. For anchors built into exterior walls, steel sheet complying with ASTM A 1008/A 1008M or ASTM A 1011/A 1011M, hot-dip galvanized according to ASTM A 153/A 153M, Class B.
- E. Inserts, Bolts, and Fasteners: Hot-dip galvanized according to ASTM A 153/A 153M.
- F. Powder-Actuated Fasteners in Concrete: Fastener system of type suitable for application indicated, fabricated from corrosion-resistant materials, with clips or other accessory devices for attaching hollow metal frames of type indicated.
- G. Grout: ASTM C 476, except with a maximum slump of 4 inches (102 mm), as measured according to ASTM C 143/C 143M.
- H. Mineral-Fiber Insulation: ASTM C 665, Type I (blankets without membrane facing); consisting of fibers manufactured from slag or rock wool with 6- to 12-lb/cu. ft. (96- to 192-kg/cu. m) density; with maximum flame-spread and smoke-development indexes of 25 and 50, respectively; passing ASTM E 136 for combustion characteristics.

- I. Glazing: Comply with requirements in Division 08 Section "Glazing."
- J. Bituminous Coating: Cold-applied asphalt mastic, SSPC-Paint 12, compounded for 15-mil (0.4-mm) dry film thickness per coat. Provide inert-type noncorrosive compound free of asbestos fibers, sulfur components, and other deleterious impurities.

2.3 EXTERIOR STANDARD STEEL DOORS AND FRAMES

- A. Construct hollow-metal doors and frames to comply with standards indicated for materials, fabrication, hardware locations, hardware reinforcement, tolerances, and clearances, and as specified.
- B. Heavy-Duty Doors and Frames: ANSI/SDI A250.8, Level 2; ANSI/SDI A250.4, Level B. At locations indicated in the Door and Frame Schedule.
 - 1. Doors:
 - a. Type: As indicated in the Door and Frame Schedule.
 - b. Thickness: 1-3/4 inches.
 - c. Face: Metallic-coated steel sheet, minimum thickness of 0.042 inch (1.0 mm), with minimum A60 coating.
 - d. Edge Construction: Model 2, Seamless.
 - e. Top Edge Closures: Close top edges of doors with flush closures of same material as face sheets. Seal joints against water penetration.
 - f. Bottom Edges: Close bottom edges of doors where required for attachment of weather stripping with end closures or channels of same material as face sheets. Provide weep-hole openings in bottoms of exterior doors to permit moisture to escape.
 - g. Core: Manufacturers standard insulated core
 - 2. Frames:
 - a. Materials: Metallic-coated steel sheet, minimum thickness of 0.053 inch (1.3 mm), with minimum A60 coating.
 - b. Construction: Full profile welded.
 - 3. Exposed Finish: Prime.

2.4 HOLLOW METAL PANELS

- A. Provide hollow metal panels of same materials, construction, and finish as specified for adjoining hollow metal work.

2.5 STOPS AND MOLDINGS

- A. Moldings for Glazed Lites in Doors: Minimum 0.032 inch (0.8 mm) thick, fabricated from same material as door face sheet in which they are installed.
- B. Fixed Frame Moldings: Formed integral with hollow metal frames, a minimum of 5/8 inch (16 mm) high unless otherwise indicated.
- C. Loose Stops for Glazed Lites in Frames: Minimum 0.032 inch (0.8 mm) thick, fabricated from same material as frames in which they are installed.

2.6 ACCESSORIES

- A. Mullions and Transom Bars: Join to adjacent members by welding or rigid mechanical anchors.
- B. Ceiling Struts: Minimum 1/4-inch-thick by 1-inch- (6.4-mm-thick by 25.4-mm-) wide steel.
- C. Grout Guards: Formed from same material as frames, not less than 0.016 inch (0.4 mm) thick.

2.7 FABRICATION

- A. Fabricate hollow metal work to be rigid and free of defects, warp, or buckle. Accurately form metal to required sizes and profiles, with minimum radius for thickness of metal. Where practical, fit and assemble units in manufacturer's plant. To ensure proper assembly at Project site, clearly identify work that cannot be permanently factory assembled before shipment.
- B. Hollow Metal Doors:
 - 1. Exterior Doors: Provide weep-hole openings in bottom of exterior doors to permit moisture to escape. Seal joints in top edges of doors against water penetration.
 - 2. Glazed Lites: Factory cut openings in doors.
- C. Hollow Metal Frames: Where frames are fabricated in sections due to shipping or handling limitations, provide alignment plates or angles at each joint, fabricated of same thickness metal as frames.
 - 1. Welded Frames: Weld flush face joints continuously; grind, fill, dress, and make smooth, flush, and invisible.
 - 2. Provide countersunk, flat- or oval-head exposed screws and bolts for exposed fasteners unless otherwise indicated.
 - 3. Grout Guards: Weld guards to frame at back of hardware mortises in frames to be grouted.
 - 4. Floor Anchors: Weld anchors to bottom of jambs and mullions with at least four spot welds per anchor.
 - 5. Jamb Anchors: Provide number and spacing of anchors as follows:
 - a. Masonry Type: Locate anchors not more than 18 inches (457 mm) from top and bottom of frame. Space anchors not more than 32 inches (813 mm) o.c. and as follows:
 - 1) Two anchors per jamb up to 60 inches (1524 mm) high.
 - 2) Three anchors per jamb from 60 to 90 inches (1524 to 2286 mm) high.
 - 3) Four anchors per jamb from 90 to 120 inches (2286 to 3048 mm) high.
 - 4) Four anchors per jamb plus 1 additional anchor per jamb for each 24 inches (610 mm) or fraction thereof above 120 inches (3048 mm) high.
 - b. Stud-Wall Type: Locate anchors not more than 18 inches (457 mm) from top and bottom of frame. Space anchors not more than 32 inches (813 mm) o.c. and as follows:
 - 1) Three anchors per jamb up to 60 inches (1524 mm) high.
 - 2) Four anchors per jamb from 60 to 90 inches (1524 to 2286 mm) high.
 - 3) Five anchors per jamb from 90 to 96 inches (2286 to 2438 mm) high.
 - 4) Five anchors per jamb plus 1 additional anchor per jamb for each 24 inches (610 mm) or fraction thereof above 96 inches (2438 mm) high.
 - 5) Two anchors per head for frames above 42 inches (1066 mm) wide and mounted in metal-stud partitions.
 - c. Compression Type: Not less than two anchors in each jamb.

- d. Postinstalled Expansion Type: Locate anchors not more than 6 inches (152 mm) from top and bottom of frame. Space anchors not more than 26 inches (660 mm) o.c.
6. Door Silencers: Except on weather-stripped doors, drill stops to receive door silencers as follows. Keep holes clear during construction.
 - a. Single-Door Frames: Drill stop in strike jamb to receive three door silencers.
 - b. Double-Door Frames: Drill stop in head jamb to receive two door silencers.
- D. Fabricate concealed stiffeners, edge channels, and hardware reinforcement from either cold- or hot-rolled steel sheet.
- E. Hardware Preparation: Factory prepare hollow metal work to receive templated mortised hardware; include cutouts, reinforcement, mortising, drilling, and tapping according to the Door Hardware Schedule and templates furnished as specified in Division 08 Section "Door Hardware."
 1. Locate hardware as indicated, or if not indicated, according to ANSI/SDI A250.8.
 2. Reinforce doors and frames to receive nontemplated, mortised and surface-mounted door hardware.
 3. Comply with applicable requirements in ANSI/SDI A250.6 and ANSI/DHI A115 Series specifications for preparation of hollow metal work for hardware.
 4. Coordinate locations of conduit and wiring boxes for electrical connections with Division 26 Sections.
- F. Stops and Moldings: Provide stops and moldings around glazed lites where indicated. Form corners of stops and moldings with butted or mitered hairline joints.
 1. Single Glazed Lites: Provide fixed stops and moldings welded on secure side of hollow metal work.
 2. Multiple Glazed Lites: Provide fixed and removable stops and moldings so that each glazed lite is capable of being removed independently.
 3. Provide fixed frame moldings on outside of exterior and on secure side of interior doors and frames.
 4. Provide loose stops and moldings on inside of hollow metal work.
 5. Coordinate rabbet width between fixed and removable stops with type of glazing and type of installation indicated.

2.8 STEEL FINISHES

- A. Prime Finish: Apply manufacturer's standard primer immediately after cleaning and pretreating.
 1. Shop Primer: Manufacturer's standard, fast-curing, lead- and chromate-free primer complying with ANSI/SDI A250.10 acceptance criteria; recommended by primer manufacturer for substrate; compatible with substrate and field-applied coatings despite prolonged exposure.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

- B. Examine roughing-in for embedded and built-in anchors to verify actual locations before frame installation.
- C. For the record, prepare written report, endorsed by Installer, listing conditions detrimental to performance of the Work.
- D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Remove welded-in shipping spreaders installed at factory. Restore exposed finish by grinding, filling, and dressing, as required to make repaired area smooth, flush, and invisible on exposed faces.
- B. Prior to installation, adjust and securely brace welded hollow metal frames for squareness, alignment, twist, and plumbness to the following tolerances:
 - 1. Squareness: Plus or minus 1/16 inch (1.6 mm), measured at door rabbet on a line 90 degrees from jamb perpendicular to frame head.
 - 2. Alignment: Plus or minus 1/16 inch (1.6 mm), measured at jambs on a horizontal line parallel to plane of wall.
 - 3. Twist: Plus or minus 1/16 inch (1.6 mm), measured at opposite face corners of jambs on parallel lines, and perpendicular to plane of wall.
 - 4. Plumbness: Plus or minus 1/16 inch (1.6 mm), measured at jambs on a perpendicular line from head to floor.
- C. Drill and tap doors and frames to receive nontemplated, mortised, and surface-mounted door hardware.

3.3 INSTALLATION

- A. General: Install hollow metal work plumb, rigid, properly aligned, and securely fastened in place; comply with Drawings and manufacturer's written instructions.
- B. Hollow Metal Frames: Install hollow metal frames of size and profile indicated.
 - 1. Set frames accurately in position, plumbed, aligned, and braced securely until permanent anchors are set. After wall construction is complete, remove temporary braces, leaving surfaces smooth and undamaged.
 - a. Where frames are fabricated in sections because of shipping or handling limitations, field splice at approved locations by welding face joint continuously; grind, fill, dress, and make splice smooth, flush, and invisible on exposed faces.
 - b. Install frames with removable glazing stops located on secure side of opening.
 - c. Install door silencers in frames before grouting.
 - d. Remove temporary braces necessary for installation only after frames have been properly set and secured.
 - e. Check plumbness, squareness, and twist of frames as walls are constructed. Shim as necessary to comply with installation tolerances.
 - f. Field apply bituminous coating to backs of frames that are filled with grout containing antifreezing agents.

2. Floor Anchors: Provide floor anchors for each jamb and mullion that extends to floor, and secure with postinstalled expansion anchors.
 - a. Floor anchors may be set with powder-actuated fasteners instead of postinstalled expansion anchors if so indicated and approved on Shop Drawings.
 3. Metal-Stud Partitions: Solidly pack mineral-fiber insulation behind frames.
 4. Masonry Walls: Coordinate installation of frames to allow for solidly filling space between frames and masonry with grout.
 5. In-Place Concrete or Masonry Construction: Secure frames in place with postinstalled expansion anchors. Countersink anchors, and fill and make smooth, flush, and invisible on exposed faces.
 6. In-Place Gypsum Board Partitions: Secure frames in place with postinstalled expansion anchors through floor anchors at each jamb. Countersink anchors, and fill and make smooth, flush, and invisible on exposed faces.
 7. Ceiling Struts: Extend struts vertically from top of frame at each jamb to overhead structural supports or substrates above frame unless frame is anchored to masonry or to other structural support at each jamb. Bend top of struts to provide flush contact for securing to supporting construction. Provide adjustable wedged or bolted anchorage to frame jamb members.
 8. Installation Tolerances: Adjust hollow metal door frames for squareness, alignment, twist, and plumb to the following tolerances:
 - a. Squareness: Plus or minus 1/16 inch (1.6 mm), measured at door rabbet on a line 90 degrees from jamb perpendicular to frame head.
 - b. Alignment: Plus or minus 1/16 inch (1.6 mm), measured at jambs on a horizontal line parallel to plane of wall.
 - c. Twist: Plus or minus 1/16 inch (1.6 mm), measured at opposite face corners of jambs on parallel lines, and perpendicular to plane of wall.
 - d. Plumbness: Plus or minus 1/16 inch (1.6 mm), measured at jambs at floor.
- C. Hollow Metal Doors: Fit hollow metal doors accurately in frames, within clearances specified below. Shim as necessary.
1. Non-Fire-Rated Standard Steel Doors:
 - a. Jambs and Head: 1/8 inch (3 mm) plus or minus 1/16 inch (1.6 mm).
 - b. Between Edges of Pairs of Doors: 1/8 inch (3 mm) plus or minus 1/16 inch (1.6 mm).
 - c. Between Bottom of Door and Top of Threshold: Maximum 3/8 inch (9.5 mm).
 - d. Between Bottom of Door and Top of Finish Floor (No Threshold): Maximum 3/4 inch (19 mm).
 2. Smoke-Control Doors: Install doors according to NFPA 105.
- D. Glazing: Comply with installation requirements in Division 08 Section "Glazing" and with hollow metal manufacturer's written instructions.
1. Secure stops with countersunk flat- or oval-head machine screws spaced uniformly not more than 9 inches (230 mm) o.c. and not more than 2 inches (50 mm) o.c. from each corner.
- 3.4 ADJUSTING AND CLEANING
- A. Final Adjustments: Check and readjust operating hardware items immediately before final inspection. Leave work in complete and proper operating condition. Remove and replace defective work, including hollow metal work that is warped, bowed, or otherwise unacceptable.
 - B. Remove grout and other bonding material from hollow metal work immediately after installation.

- C. Prime-Coat Touchup: Immediately after erection, sand smooth rusted or damaged areas of prime coat and apply touchup of compatible air-drying, rust-inhibitive primer.
- D. Metallic-Coated Surfaces: Clean abraded areas and repair with galvanizing repair paint according to manufacturer's written instructions.

END OF SECTION 081113

SECTION 084113 - ALUMINUM ENTRANCES AND STOREFRONTS

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes the following:
 - 1. Thermally Broken, Aluminum Storefront and Entrances
 - 2. Thermally Broken, Operable Windows installed as part of Storefront systems.
 - 3. Thermal, Aluminum Entrance Doors

1.2 SYSTEM DESCRIPTION

- A. General: Provide aluminum window and storefront systems capable of withstanding loads and thermal and structural movement requirements indicated without failure, based on testing manufacturer's standard units in assemblies similar to those indicated for this Project.
- B. Glazing: Physically and thermally isolate glazing from framing members.
- C. Glazing-to-Glazing Joints: Provide glazing-to-glazing joints that accommodate thermal and mechanical movements of glazing and system, prevent glazing-to-glazing contact, and maintain required edge clearances.
- D. Thermally Broken Construction: Provide systems that isolate aluminum exposed to exterior from aluminum exposed to interior with a material of low thermal conductance.
- E. Provide continuous sub-sill components at all sill conditions to drain water from storefront system to the exterior.

1.3 PERFORMANCE REQUIREMENTS – STOREFRONT SYSTEMS

- A. Performance Requirements: Provide aluminum storefront systems that comply with performance requirements indicated, as demonstrated by testing manufacturer's assemblies in accordance with test method indicated.
- B. Air Infiltration: Completed storefront systems shall have 0.06 CFM/FT² (1.10 m³/h·m²) maximum allowable infiltration when tested in accordance with ASTM E 283 at differential static pressure of 6.24 PSF (299 Pa).
- C. Water Infiltration: No uncontrolled water when tested in accordance with ASTM E 331 at test pressure differential of: 10 PSF (479 Pa) (or when required, field tested in accordance with AAMA 503). Fastener Heads must be seated and sealed against Sill Flashing on any fasteners that penetrate through the Sill Flashing.

- D. Wind Loads: Completed storefront system shall withstand wind pressure loads normal to wall plane indicated:
1. Exterior Walls:
 - a. Positive Pressure: 60 PSF per ASTM E330.
 2. Deflection: Maximum allowable deflection in any member when tested in accordance with ASTM E 330 with allowable stress in accordance with AA Specifications for Aluminum Structures.
 - a. 40 PSF per ASTM E330
- E. Thermal Movement: Provide for thermal movement caused by 180 degrees F. (82.2 degrees C.) surface temperature, without causing buckling stresses on glass, joint seal failure, undue stress on structural elements, damaging loads on fasteners, reduction of performance, or detrimental effects.
- F. Thermal Performance: When tested in accordance with AAMA 507, AAMA 1503, and NFRC 100:
1. Front Set Glass:
 - a. U-factor = .33; CRF = 68
 2. Center Set Glass:
 - a. U-factor = .32; CRF = 63

1.4 PERFORMANCE REQUIREMENTS – ENTRANCE DOORS

- A. Performance Requirements: Provide aluminum swing doors that comply with performance requirements indicated, as demonstrated by testing manufacturer's assemblies in accordance with test methods indicated.
1. Air infiltration @ 1.57 (75 PA) psf: Air leakage for single doors shall not exceed 0.20 CFM/FT² when tested in accordance with ASTM E283. Air infiltration @ 1.57 (75 PA) psf: Air leakage for pairs of doors shall not exceed 1.00 CFM/FT² (when tested in accordance with ASTM E283.
 2. Air infiltration@ 6.24 (300 PA) psf: Air leakage for single doors shall not exceed 0.50 CFM/FT² when tested in accordance with ASTM E283.
 3. Wind loads single: Provide framing system capable of withstanding wind load design pressures of 50 psf (2394 PA) acting inward and 50 psf (2394 PA) acting outward. The design pressures are to be tested per ASTM E-330.
 4. Wind loads pair: Provide framing system capable of withstanding wind load design pressures of 50 psf (2394 PA) acting inward and 50 (2394 PA) psf acting outward. The design pressures are to be tested per ASTM E-330.
 5. Forced Entry testing per AAMA1304
 6. Cycle Test per AAMA 920-16 for 500,000 cycles.

1.5 SUBMITTALS

- A. Product Data: For each product specified. Include details of construction relative to materials, dimensions of individual components, profiles, and finishes.

- B. Shop Drawings: For entrance and storefront systems. Show details of fabrication and installation, including plans, elevations, sections and details of components, provisions for expansion and contraction, and attachments to other work.
 - 1. Shop drawings shall be project specific and indicate each jamb, head and sill condition.
 - 2. Shop drawings shall be based on field verified information and dimensions.
 - 3. Entrance door hardware components and finishes
- C. Samples for Verification: Of each type of exposed finish required in manufacturer's standard sizes. Where finishes involve normal color and texture variations, include Sample sets showing the full range of variations expected.

1.6 QUALITY ASSURANCE

- A. Installer Qualifications: Engage an experienced installer to assume engineering responsibility and perform work of this Section who has specialized in installing entrance and storefront systems similar to those required for this Project and who is acceptable to manufacturer.
 - 1. Engineering Responsibility: Prepare data for entrance and storefront systems, including Shop Drawings, based on testing and engineering analysis of manufacturer's standard units in assemblies similar to those indicated for this Project.
- B. Source Limitations: Obtain each type of entrance and storefront system through one source from a single manufacturer.
- C. Product Options: Drawings indicate size, profiles, and dimensional requirements of entrance and storefront systems and are based on the specific systems indicated. Other manufacturers' systems with equal performance characteristics may be considered.
 - 1. Do not modify intended aesthetic effect, as judged solely by Architect, except with Architect's approval and only to the extent needed to comply with performance requirements. Where modifications are proposed, submit comprehensive explanatory data to Architect for review.

1.7 PROJECT CONDITIONS

- A. Field Measurements: Verify dimensions by field measurements before fabrication and indicate measurements on Shop Drawings. Coordinate fabrication schedule with construction progress to avoid delaying the Work.

1.8 WARRANTY

- A. General Warranty: The special warranty specified in this Article shall not deprive the Owner of other rights the Owner may have under other provisions of the Contract Documents and shall be in addition to, and run concurrent with, other warranties made by the Contractor under requirements of the Contract Documents.

- B. Special Warranty: Submit a written warranty executed by the manufacturer agreeing to repair or replace components of entrance and storefront systems that fail in materials or workmanship within the specified warranty period. Failures include, but are not limited to, the following:
 - 1. Structural failures including, but not limited to, excessive deflection.
 - 2. Deterioration of metals, metal finishes, and other materials beyond normal weathering.
 - 3. Failure of operating components to function normally.
 - 4. Water leakage through fixed glazing and frame areas.
- C. Warranty Period: 2 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
- B. Aluminum Storefront and entrance systems:
 - 1. Oldcastle Building Envelope – Series 3000 Thermal MultiPlane (Basis of Design)
 - 2. EFCO
 - 3. YKK-AP
- C. Provide compatible, integrated operable window systems where indicated.
- D. Provide compatible louvers installed as part of the storefront system to serve existing unit ventilator units.
- E. Provide center set, front set or back set glazing options as selected by Architect.
- F. Entrance Doors: Manufacturer's standard glazed entrance doors for manual-swing or automatic operation.
 - 1. Door Construction: 1-3/4-inch (44.5-mm) overall thickness, with minimum 0.125-inch- (3.2-mm-) thick, extruded-aluminum tubular rail and stile members. Mechanically fasten corners with reinforcing brackets that are deeply penetrated and fillet welded or that incorporate concealed tie rods.
 - a. Thermal Construction: High-performance plastic connectors separate aluminum members exposed to the exterior from members exposed to the interior.
 - 2. Door Design: Medium stile; 3-1/2-inch (88.9-mm) nominal width
 - 3. Glazing Stops and Gaskets: Beveled, snap-on, extruded-aluminum stops and preformed gaskets.
 - a. Provide nonremovable glazing stops on outside of door.
 - 4. Finish: Match adjacent storefront framing finish.

2.2 ENTRANCE DOOR HARDWARE

- A. Entrance Door Hardware: Hardware not specified in this Section is specified in Section 087111 "Door Hardware (Descriptive Specification)."

- B. General: Provide entrance door hardware and entrance door hardware sets indicated in door and frame schedule for each entrance door, to comply with requirements in this Section.
1. Entrance Door Hardware Sets: Provide quantity, item, size, finish or color indicated, and named manufacturers' products or identified in Section 087111 Door Hardware (Descriptive Specification).
 2. Sequence of Operation: Provide electrified door hardware function, sequence of operation, and interface with other building control systems indicated.
 3. Opening-Force Requirements:
 - a. Egress Doors: Not more than 15 lbf (67 N) to release the latch and not more than 30 lbf (133 N) to set the door in motion and not more than 15 lbf (67 N) to open the door to its minimum required width.
 - b. Accessible Interior Doors: Not more than 5 lbf (22.2 N) to fully open door.
- C. Designations: Requirements for design, grade, function, finish, quantity, size, and other distinctive qualities of each type of entrance door hardware are indicated in "Entrance Door Hardware Sets" Article. Products are identified by using entrance door hardware designations as follows:
1. Named Manufacturers' Products: Manufacturer and product designation are listed for each door hardware type required for the purpose of establishing minimum requirements. Manufacturers' names are abbreviated in "Entrance Door Hardware Sets" Article.
 2. References to BHMA Standards: Provide products complying with these standards and requirements for description, quality, and function.
- D. Continuous-Gear Hinges: BHMA A156.26.
1. Markar FM200 (City Standard)
- E. Automatic and Self-Latching Flush Bolts: BHMA A156.3, Grade 1.
- F. Panic Exit Devices: Corbin Russwin ED4200 or ED4800 (City Standard)
- G. Cylinders:
1. BHMA A156.5, Grade 1.
 - a. Keying: Match Owner's Standard
- H. Strikes: Provide strike with black-plastic dust box for each latch or lock bolt; fabricated for aluminum framing.
- I. Operating Trim: BHMA A156.6.
- J. Closers: Corbin Russwin DC8210 Series, A12 (City Standard).
- K. Door Stops: BHMA A156.16, Grade 1, floor or wall mounted, as appropriate for door location indicated, with integral rubber bumper.
- L. Weather Stripping: Manufacturer's standard replaceable components.
1. Compression Type: Made of ASTM D2000 molded neoprene or ASTM D2287 molded PVC.
- M. Weather Sweeps: Manufacturer's standard exterior-door bottom sweep with concealed fasteners on mounting strip.

- N. Thresholds: BHMA A156.21 raised thresholds beveled with a slope of not more than 1:2, with maximum height of 1/2 inch (12.7 mm).

2.3 MATERIALS

- A. Extrusions: ASTM B 221 (ASTM B 221M), 6063-T5 Aluminum Alloy.
- B. Aluminum Closure Panel Extrusions: .125" aluminum closure panels where indicated, finished to match aluminum storefront framing.
- C. Aluminum Sheet:
 - 1. Anodized Finish: ASTM B 209 (ASTM B 209M), 5005-H14 Aluminum Alloy, 0.050" (1.27 mm) minimum thickness.
 - 2. Painted Finish: ASTM B 209 (ASTM B 209M), 3003-H14 Aluminum Alloy, 0.080" (1.95 mm) minimum thickness.

2.4 ACCESSORIES

- A. Automatic Door Operators: Section 087113 "Automatic Door Operators."
- B. Manufacturer's Standard Accessories:
 - 1. Fasteners: Zinc plated steel concealed fasteners; Hardened aluminum alloys or AISI 300 series stainless steel exposed fasteners.
 - 2. Glazing gaskets – Storefront:
 - a. Compression type design, replaceable, molded or extruded, of neoprene, polyvinyl chloride (PVC), or ethylene propylene diene monomer (EPDM).
 - b. Profile and hardness as required to maintain uniform pressure for watertight seal
 - 3. Glazing gaskets - Doors:
 - a. Compression type design, replaceable, molded or extruded, silicone, or ethylene propylene diene monomer (EPDM). Profile and hardness as required, to maintain uniform pressure for watertight seal
 - 4. Thermal separation consisting of extruded glass reinforced Polyamide
 - 5. Internal sealants and baffles.
 - 6. Aluminum louvers installed as part of the aluminum storefront system where indicated.
 - a. Louvers shall be installed into glazing pockets and shall be removable for future installation of 1" glazing units at those locations.
 - b. Louvers shall match framing finish.

7. Dual Weather-stripping – Doors:

- a. Provide Bulb gasket full perimeter of frame
- b. Provide EPDM or silicone gasket weather stripping in bottom and top door rail, for contact with threshold and door header.
- c. Provide EPDM extruded gasket at jambs and door headers.
- d. Provide pile weather stripping at exterior and dual bulb weather stripping at interior of adjustable astragals on pairs of doors.

2.5 RELATED MATERIALS

- A. Glass: Refer to Division 8 Glass and Glazing Section for glass materials.
- B. Additional glazing units matching specified glass shall be provided for future installation at all louver locations. Glazing units shall be fabricated, packed and crated for long term storage at Owner's designated location for future installation by Owner.

2.6 FABRICATION

- A. Shop Assembly: Fabricate and assemble units with joints only at intersection of aluminum members with uniform hairline joints; rigidly secure, and sealed in accordance with manufacturer's recommendations.
 1. Hardware: Drill and cut to template for hardware. Reinforce frames and door stiles to receive hardware in accordance with manufacturer's recommendations.
 2. Welding: Conceal welds on aluminum members in accordance with AWS recommendations or methods recommended by manufacturer. Members showing welding bloom or discoloration on finish or material distortion will be rejected.
- B. Entrance Door Frames: Reinforce as required to support loads imposed by door operation and for installing entrance door hardware.
 1. At interior and exterior doors, provide compression weather stripping at fixed stops.
- C. Entrance Doors: Reinforce doors as required for installing entrance door hardware.
 1. At pairs of exterior doors, provide sliding-type weather stripping retained in adjustable strip and mortised into door edge.
 2. At exterior doors, provide weather sweeps applied to door bottoms.
- D. Entrance Door Hardware Installation: Factory install entrance door hardware to the greatest extent possible. Cut, drill, and tap for factory-installed entrance door hardware before applying finishes.

2.7 ALUMINUM FINISHES

- A. General: Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations relative to applying and designating finishes.
- B. Finish designations prefixed by AA comply with the system established by the Aluminum Association for designating aluminum finishes.

- C. Architect shall select from either anodized or high performance organic coatings outlined below depending on location within project.
- D. High-Performance Organic Finish: 2-coat fluoropolymer finish complying with AAMA 2605 and containing not less than 70 percent PVDF resin by weight in color coat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
 - 1. Color and Gloss: As selected by Architect from full range of industry colors and color densities.
- E. Clear Anodic Finish: AAMA 611, AA-M12C22A41, Class I, 0.018 mm thicker.

2.8 GLAZING ACCESSORIES

- A. Glazing as specified in Division 8 Section "Glazing."
- B. Glazing Gaskets: Manufacturer's standard pressure-glazing system of black, resilient glazing gaskets, setting blocks, and shims or spacers, fabricated from an elastomer of type and in hardness recommended by system and gasket manufacturer to comply with system performance requirements. Provide gasket assemblies that have corners sealed with sealant recommended by gasket manufacturer.
- C. Spacers, Setting Blocks, Gaskets, and Bond Breakers: Manufacturer's standard permanent, nonmigrating types in hardness recommended by manufacturer, compatible with sealants, and suitable for system performance requirements.
- D. Secondary Sealant: For use as weatherseal, compatible with structural silicone sealant and other system components with which it comes in contact, and that accommodates a 50 percent increase or decrease in joint width at the time of application when measured according to ASTM C 719.
 - 1. Color: Black.
 - 2. Use neutral-cure silicone sealant with insulating-glass units.
- E. Framing system gaskets, sealants, and joint fillers as recommended by manufacturer for joint type.
- F. Sealants and joint fillers for joints at perimeter of entrance and storefront systems as specified in Division 7 Section "Joint Sealants."
- G. 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.
 - 1. Not less than 27 for 1" standard insulating unit; 30 for laminated glazing.

2.9 COMPONENTS

- A. Brackets and Reinforcements: Provide manufacturer's standard brackets and reinforcements that are compatible with adjacent materials. Provide non-staining, nonferrous shims for aligning system components.

- B. Fasteners and Accessories: Manufacturer's standard corrosion-resistant, nonstaining, nonbleeding fasteners and accessories compatible with adjacent materials.
 - 1. Reinforce members as required to retain fastener threads.
 - 2. Do not use exposed fasteners, except for hardware application. For hardware application, use countersunk Phillips flat-head machine screws finished to match framing members or hardware being fastened, unless otherwise indicated.
- C. Concrete and Masonry Inserts: Hot-dip galvanized cast-iron, malleable-iron, or steel inserts complying with ASTM A 123 or ASTM A 153 requirements.
- D. Continuous aluminum sub-sill extrusion, thermally broken and finished to match storefront framing system.
- E. Provide aluminum closure panels, trim and attachment clips with concealed anchorage as indicated in details.
 - 1. Match finish of storefront system.
- F. Provide miscellaneous aluminum sheet for trim and exposed flashing components in .050" minimum thickness. Finish to match storefront framing system.
- G. Concealed Flashing: Manufacturer's standard corrosion-resistant, nonstaining, nonbleeding flashing, compatible with adjacent materials, and of type recommended by manufacturer.
- H. Aluminum louvers shall be finished to match storefront framing system and shall be designed to be removed and replaced with vision glass units in future phases of work.

2.10 FABRICATION

- A. General: Fabricate components that, when assembled, will have accurately fitted joints with ends coped or mitered to produce hairline joints free of burrs and distortion. After fabrication, clearly mark components to identify their locations in Project according to Shop Drawings.
- B. Fabricate components to drain water passing joints and condensation and moisture occurring or migrating within the system to the exterior.
- C. Glazing Channels: Provide minimum clearances for thickness and type of glass indicated according to FGMA's "Glazing Manual."
- D. Metal Protection: Where aluminum will contact dissimilar metals, protect against galvanic action by painting contact surfaces with primer or by applying sealant or tape recommended by manufacturer for this purpose. Where aluminum will contact concrete or masonry, protect against corrosion by painting contact surfaces with bituminous paint.
- E. Field verify conditions of existing framing components to receive new aluminum window system components prior to shop drawing submission.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine areas, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of entrance and storefront systems. Do not proceed with installation until unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. General: Comply with manufacturer's written instructions for protecting, handling, and installing entrance and storefront systems. Do not install damaged components. Fit frame joints to produce hairline joints free of burrs and distortion. Rigidly secure non-movement joints. Seal joints watertight.
- B. Metal Protection: Where aluminum will contact dissimilar metals, protect against galvanic action by painting contact surfaces with primer or by applying sealant or tape recommended by manufacturer for this purpose. Where aluminum will contact concrete or masonry, protect against corrosion by painting contact surfaces with bituminous paint.
- C. Install components to drain water passing joints and condensation and moisture occurring or migrating within the system to the exterior.
- D. Set continuous sill members and flashing in a full sealant bed to provide weathertight construction, unless otherwise indicated. Comply with requirements of Division 7 Section "Joint Sealants."
- E. Seal perimeter of all framing components with spray applied foam insulation to seal all gaps and voids. Trim back foam for installation of sealant joints.
- F. Install framing components plumb and true in alignment with established lines and grades without warp or rack of framing members.
- G. Install glazing to comply with requirements of Division 8 Section "Glazing," unless otherwise indicated.
 - 1. Prepare surfaces that will contact structural sealant according to sealant manufacturer's written instructions to ensure compatibility and adhesion. Preparation includes, but is not limited to, cleaning and priming surfaces.
 - 2. Install structural silicone sealant according to sealant manufacturer's written instructions.
 - 3. Mechanically fasten glazing in place until structural sealant is cured.
 - 4. Remove excess sealant from component surfaces before sealant has cured.
- H. Install secondary-sealant weatherseal according to sealant manufacturer's written instructions to provide weatherproof joints. Install joint fillers behind sealant as recommended by sealant manufacturer.
- I. Erection Tolerances: Install entrance and storefront systems to comply with the following maximum tolerances:
 - 1. Variation from Plane: Limit variation from plane or location shown to 1/8 inch in 12 feet (3 mm in 3.7 m); 1/4 inch (6 mm) over total length.
 - 2. Alignment: Where surfaces abut in line, limit offset from true alignment to 1/16 inch (1.5 mm). Where surfaces meet at corners, limit offset from true alignment to 1/32 inch (0.8 mm).
 - 3. Diagonal Measurements: Limit difference between diagonal measurements to 1/8 inch (3 mm).

3.3 INSTALLATION OF ALUMINUM-FRAMED ENTRANCE DOORS

- A. Install entrance doors to produce smooth operation and tight fit at contact points.
 - 1. Exterior Doors: Install to produce weathertight enclosure and tight fit at weather stripping.
 - 2. Field-Installed Entrance Door Hardware: Install surface-mounted entrance door hardware according to entrance door hardware manufacturers' written instructions using concealed fasteners to greatest extent possible.

3.4 FIELD QUALITY CONTROL

- A. Structural-Silicone-Sealant Adhesion Test: Test installed structural silicone sealant according to field adhesion test method described in AAMA CW #13, "Structural Sealant Glazing Systems (A Design Guide)."
 - 1. Test a minimum of 2 areas.
- B. Repair or remove and replace Work that does not meet requirements or that is damaged by testing; replace to conform to specified requirements.

3.5 ADJUSTING AND CLEANING

- A. Remove excess sealant and glazing compounds, and dirt from surfaces.

3.6 MAINTENANCE SERVICE

- A. Entrance Door Hardware Maintenance:
 - 1. Maintenance Tools and Instructions: Furnish a complete set of specialized tools and maintenance instructions as needed for Owner's continued adjustment, maintenance, and removal and replacement of entrance door hardware.

3.7 PROTECTION

- A. Provide final protection and maintain conditions, in a manner acceptable to manufacturer and Installer that ensure entrance and storefront systems are without damage or deterioration at the time of Substantial Completion.

END OF SECTION 084113

SECTION 087111 - DOOR HARDWARE

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes the following:
 - 1. Commercial door hardware for swinging doors.

1.3 SUBMITTALS

- A. Product Data: Include installation details, material descriptions, dimensions of individual components and profiles, and finishes.
- B. Door Hardware Schedule: Prepared by or under the supervision of supplier, detailing fabrication and assembly of door hardware, as well as procedures and diagrams. Coordinate the final Door Hardware Schedule with doors, frames, and related work to ensure proper size, thickness, hand, function, and finish of door hardware.
- C. Warranties: Special warranties specified in this Section.

1.4 QUALITY ASSURANCE

- A. Installer Qualifications: An experienced installer who has completed door hardware similar in material, design, and extent to that indicated for this Project and whose work has resulted in construction with a record of successful in-service performance.
- B. Supplier Qualifications: Door hardware supplier with warehousing facilities in Project's vicinity and who is or employs a qualified Architectural Hardware Consultant, available during the course of the Work to consult with Contractor, Architect, and Owner about door hardware and keying.
- C. Source Limitations: Obtain each type and variety of door hardware from a single manufacturer, unless otherwise indicated.
- D. 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)," 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.

- b. Door Closers: Comply with the following maximum opening-force requirements indicated:
 - 1) Interior Hinged Doors: 5 lbf (22.2 N) applied perpendicular to door.
 - c. Thresholds: Not more than 1/2 inch (13 mm) high. Bevel raised thresholds with a slope of not more than 1:2.
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.
 - c. Thresholds: Not more than 1/2 inch (13 mm) high.
- 1.5 DELIVERY, STORAGE, AND HANDLING
- A. Inventory door hardware on receipt and provide secure lock-up for door hardware delivered to Project site.
 - B. Tag each item or package separately with identification related to the final Door Hardware Schedule, and include basic installation instructions with each item or package.
 - C. Deliver keys to Owner by registered mail or overnight package service.
- 1.6 COORDINATION
- A. Templates: Obtain and distribute to the parties involved templates for doors, frames, and other work specified to be factory prepared for installing door hardware. Check Shop Drawings of other work to confirm that adequate provisions are made for locating and installing door hardware to comply with indicated requirements.
- 1.7 WARRANTY
- A. General Warranty: Special warranties specified in this Article shall not deprive Owner of other rights Owner may have under other provisions of the Contract Documents and shall be in addition to, and run concurrent with, other warranties made by Contractor under requirements of the Contract Documents.
 - B. Special Warranty: Written warranty, executed by manufacturer agreeing to repair or replace components of door hardware that fail in materials or workmanship within specified warranty period. Failures include, but are not limited to, the following:
 - 1. Structural failures including excessive deflection, cracking, or breakage.
 - 2. Faulty operation of operators and door hardware.
 - 3. Deterioration of metals, metal finishes, and other materials beyond normal weathering.
 - C. Warranty Period: Three years from date of Substantial Completion, unless otherwise indicated.
 - D. Warranty Period for Manual Closers: 10 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 SCHEDULED DOOR HARDWARE

- A. General: Provide door hardware for each door to comply with requirements in this Section.

2.2 HARDWARE MANUFACTURERS:

- A. Provide hardware by the following manufacturers per Owner standards.

HARDWARE	MANUFACTURER	MODEL NUMBERS	NOTES
Hinges	McKinney	T4A3386	5-knuckle, HW
Cont. Hinge	Markar	FM200	
Lever Handles	Corbin Russwin	Newport with D-Rose	Satin Chrome Plated
Door Closers	Corbin Russwin	DC3200 Series	Spring Power Closer
		DC8210 Series, A11	Non-Hold Open Arm
		DC8210 Series, A12	Hold Open Arm
Locksets	Corbin Russwin	CL3100 Series Cylindrical	Satin Chrome Plated
	Corbin Russwin	ML2000 Series Mortise	Mechanical
	Corbin Russwin	800 ML20800 x TCAC2 Mortise	Electrical
Exit Devices	Corbin Russwin	ED4200	Single Door
		ED4800, concealed rod	Pair of Doors
Strikes	Corbin Russwin	650F308	
Manual Flush Bolt	Pemko	FB150 series	Stainless Steel
Silencers	Rockwood		3 per leaf
Wall Stop	Trimco	1270CX	

Hardware Finish shall be US26D, Satin plated chromium or equivalent

2.3 FABRICATION

- A. Base Metals: Produce door hardware units of base metal, fabricated by forming method indicated, using manufacturer's standard metal alloy, composition, temper, and hardness. Furnish metals of a quality equal to or greater than that of specified door hardware units and for finishes. Do not furnish manufacturer's standard materials or forming methods if different from specified standard.

- B. Fasteners: Provide door hardware manufactured to comply with published templates generally prepared for machine, wood, and sheet metal screws. Provide screws according to commercially recognized industry standards for application intended. Provide Phillips flat-head screws with finished heads to match surface of door hardware, unless otherwise indicated.

1. Steel Machine or Wood Screws: For the following fire-rated applications:

- a. Mortise hinges to doors.
- b. Strike plates to frames.
- c. Closers to doors and frames.

2. Spacers or Sex Bolts: For through bolting of hollow metal doors.

2.4 FINISHES

- A. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine doors and frames, with Installer present, for compliance with requirements for installation tolerances, labeled fire door assembly construction, wall and floor construction, and other conditions affecting performance of door hardware.
- B. Examine roughing-in for electrical power systems to verify actual locations of wiring connections before electrified door hardware installation.

3.2 PREPARATION

- A. Steel Doors and Frames: Comply with DHI A115 series.

1. Surface-Applied Door Hardware: Drill and tap doors and frames according to SDI 107.

3.3 INSTALLATION

- A. Mounting Heights: Mount door hardware units at heights indicated unless specifically indicated or required to comply with governing regulations:

1. Standard Steel Doors and Frames: DHI's "Recommended Locations for Architectural Hardware for Standard Steel Doors and Frames."
2. Wood Doors: DHI WDHS.3, "Recommended Locations for Architectural Hardware for Wood Flush Doors."

- B. Install each door hardware item to comply with manufacturer's written instructions. Where cutting and fitting are required to install door hardware onto or into surfaces that are later to be painted or finished in another way, coordinate removal, storage, and reinstallation of surface protective trim units with finishing

work specified in Division 9 Sections. Do not install surface-mounted items until finishes have been completed on substrates involved.

- C. Thresholds: Set thresholds for exterior in full bed of sealant complying with requirements specified in Division 7 Section "Joint Sealants."

3.4 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 so that, from an open position of 70 degrees, the door will take at least 3 seconds to move to a point 3 inches (75 mm) from the latch, measured to the leading edge of the door.

3.5 CLEANING AND PROTECTION

- A. Clean adjacent surfaces soiled by door hardware installation.
- B. Provide final protection and maintain conditions that ensure door hardware is without damage or deterioration at time of Substantial Completion.

3.6 DOOR HARDWARE SETS - GENERAL

- A. The following door hardware sets are for initial selection and specification. Final hardware sets shall be developed by the Architectural Hardware Consultant and submitted to the Architect for review.
 - 1. Include complete hardware for all doors, access panels and other devices requiring locking cylinders keyed to the building keying system.
 - 2. Submit shop drawings and product data for all hardware devices. Provide wiring schematics for all electrified hardware devices.
 - 3. Refer to Code Review sheet for occupancy type and required code compliance authorities. Review the Code Review sheet which indicates the locations of rated walls and provide devices that meet specified ratings.
 - 4. All doors in fire rated, smoke control or corridor walls shall positively latch to the frame unless noted otherwise.
 - 5. Comply with the Ohio Building Code, adopted Life Safety Code for the occupancy type indicated.
 - 6. Provide approved shop drawings to the electrical contractor for coordination of rough-in locations.
- B. The Electrical Contractor shall provide all rough-ins for wall mounted electrified hardware devices and provide final power connections to all power supplies. Low voltage wiring and connections shall be by the hardware installer.

3.7 DOOR HARDWARE SETS

- A. Refer to table above for model numbers and finishes. Refer to hardware sets below for general hardware required for each set.

SET #1	Single Aluminum Storefront	Doors: Refer to Door Schedule	
Hardware	Manufacturer	Notes	
Continuous	Markar	See Section 084113	
Weatherstripping	Reece, Pemko, Zero	See Section 084113	
Threshold	Reece, Pemko, Zero	See Section 084113	
Exit Device	Corbin Russwin	See Section 084113	
	Keyed Nightlatch Function, ANSI 02		
Cylinder	Corbin Russwin	Match Owner's keying	
Closer	Corbin Russwin	See Section 084113	
Silencers	Rockwood		
Field verify existing frame size and rough-in requirements.			

SET #2	Pair Egress - Exterior	Doors: Refer to Door Schedule	
Hardware	Manufacturer	Notes	
6 hinges	McKinney		
Weatherstripping	Reece, Pemko, Zero		
Threshold	Reece, Pemko, Zero		
Exit Devices	Corbin Russwin		
	Keyed Nightlatch Function, ANSI 02		
Cylinder	Corbin Russwin	Match Owner's keying	
Closers	Corbin Russwin		
Silencers	Rockwood		
Field verify existing frame size and rough-in requirements.			

SET #3	Single Hollow Metal - Exterior	Doors: Refer to Door Schedule	
Hardware	Manufacturer	Notes	
3 Hinges	McKinney	Fit to existing HM frame	
Weatherstripping	Reece, Pemko, Zero	With drip cap	
Threshold	Reece, Pemko, Zero		
Exit Device	Corbin Russwin	ED4200	
	Keyed Nightlatch Function, ANSI 02		
Cylinder	Corbin Russwin	Match Owner's keying	
Closer	Corbin Russwin, DC8210-A11		
Silencers	Rockwood		
Field verify existing frame size and rough-in requirements.			

SET #4	Pair Interior	Doors: Refer to Door Schedule
Hardware	Manufacturer	Notes
6 Hinges	McKinney	
Lockset	Corbin Russwin CL3100	Storeroom, CL3157
Cylinder	Corbin Russwin	Match Owner's keying
Closers	Corbin Russwin, DC8210-A11	
Manual Flushbolts	Pemko	Inactive leaf
Silencers	Rockwood	
Field verify existing frame size and rough-in requirements.		

SET #5	Pair Exterior Storefront	Doors: Refer to Door Schedule
Hardware	Manufacturer	Notes
Cont. Hinge	Markar	
Exit Devices	Corbin Russwin	ED4800
	Keyed Nightlatch Function, ANSI 02	
Cylinder	Corbin Russwin	Match Owner's keying
Closers	Corbin Russwin, DC8210 Series-A11	DC8210 Series, A11
Automatic Flushbolts	Manufacturer's Standard	
Silencers	Rockwood	
Auto Operator	See Section 087113 Automatic Door Operators	

END OF SECTION 087111

SECTION 087113 - AUTOMATIC DOOR OPERATORS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:
 - 1. Power door operators for swinging doors.

1.3 DEFINITIONS

- A. AAADM: American Association of Automatic Door Manufacturers.
- B. Activation Device: A control that, when actuated, sends an electrical signal to the door operator to open the door.
- C. Double-Egress (Doors): A pair of doors that simultaneously swing with the two doors moving in opposite directions with no mullion between them.
- D. Double-Swing (Doors): A pair of doors that swing with the two doors moving in opposite directions with a mullion between them; each door functioning as a single-swing door.
- E. Safety Device: A control that, to avoid injury, prevents a door from opening or closing.
- F. For automatic door terminology, see BHMA A156.19 for definitions of terms.

1.4 COORDINATION

- A. Coordinate sizes and locations of recesses in concrete floors for recessed control mats that control automatic door operators. Concrete, reinforcement, and formwork requirements are specified elsewhere.
- B. Templates: Distribute for doors, frames, and other work specified to be factory prepared and reinforced for installing automatic door operators.
- C. Coordinate hardware for doors with operators to ensure proper size, thickness, hand, function, and finish.
- D. Electrical System Roughing-in: Coordinate layout and installation of automatic door operators with connections to power supplies.
- E. Pneumatic System Roughing-in: Coordinate layout and installation of automatic door operators and power units with compressed-air piping.

1.5 PREINSTALLATION MEETINGS

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

1.6 ACTION SUBMITTALS

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

1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for automatic door operators.
2. Include rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories.

- B. Shop Drawings: For automatic door operators.

1. Include plans, elevations, sections, hardware mounting heights, and attachment details.
2. Indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
3. Indicate locations of activation and safety devices.
4. Include diagrams for power, signal, and control wiring.
5. Include plans, elevations, sections, and attachment details for guide rails.

- C. Samples: For each exposed product and for each color and texture specified.

1.7 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For Installer.
- B. Product Certificates: For each type of automatic door operator.
- C. Field quality-control reports.
- D. Sample Warranties: For manufacturer's special warranties.

1.8 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For automatic door operators, safety devices, and control systems, to include in maintenance manuals.

1.9 QUALITY ASSURANCE

- A. Installer Qualifications: An authorized representative who is trained and approved by manufacturer for installation and maintenance of units required for this Project.
- B. Certified Inspector Qualifications: Certified by AAADM.

1.10 WARRANTY

- A. Special Warranty: Manufacturer agrees to repair or replace components of automatic door operators that fail in materials or workmanship within specified warranty period.
1. Failures include, but are not limited to, the following:
 - a. Faulty or sporadic operation of automatic door operator, including controls.
 - b. Deterioration of metals, metal finishes, and other materials beyond normal weathering or use.
 2. Warranty Period: Two years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Besam Entrance Solutions; an ASSA ABLOY Group Company. (SW150)
 2. DORMA USA, Inc. (DM) ED900 series
 3. Horton Automatics; a division of Overhead Door Corporation.
 4. LCN; an Allegion brand.
 5. SARGENT Manufacturing Company; ASSA ABLOY.
 6. Stanley Access Technologies.
- B. Source Limitations: Obtain automatic door operators, including activation and safety devices, from same manufacturer

2.2 AUTOMATIC DOOR OPERATORS, GENERAL

- A. General: Provide operators of size recommended by manufacturer for door size, weight, and movement; for condition of exposure; and for long-term, maintenance-free operation under normal traffic load for occupancy type indicated; and according to UL 325. Coordinate operator mechanisms with door operation, hinges, and activation and safety devices.
1. Provide 'slim' or 'low-profile' low energy operator.
 2. Wind Load: Provide door operators on exterior doors that will open and close doors and maintain them in fully closed position when subjected to wind load as indicated on the drawings.
- B. Electromechanical Operating System: Self-contained unit powered by permanent-magnet dc motor; with closing speed controlled mechanically by gear train and dynamically by braking action of electric motor, connections for power and activation- and safety-device wiring, and manual operation including spring closing when power is off.
- C. Hinges: See Section 087100 "Door Hardware" for hinge type for each door that door operator shall accommodate.

- D. Cover for Surface-Mounted Operators: Fabricated from 0.125-inch-thick, extruded or formed aluminum ; continuous over full width of door opening including door jambs; with enclosed end caps, provision for maintenance access, and fasteners concealed when door is in closed position.
- E. Brackets and Reinforcements: Fabricated from aluminum with nonstaining, nonferrous shims for aligning system components.
- F. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

2.3 LOW-ENERGY DOOR OPERATORS

- A. Standard: BHMA A156.19.
- B. Performance Requirements:
 - 1. Opening Force if Power Fails: Not more than 15 lbf required to release latch if provided, not more than 30 lbf required to manually set door in motion, and not more than 15 lbf required to fully open door.
 - 2. Entrapment-Prevention Force: Not more than 15 lbf required to prevent stopped door from closing or opening.
- C. Configuration: Operator to control single swinging door.
 - 1. Traffic Pattern: Two way.
 - 2. Operator Mounting: Surface.
- D. Operation: Power opening spring closing. Provide time delay for door to remain open before initiating closing cycle as required by BHMA A156.19. When not in automatic mode, door operator shall function as manual door closer, with or without electrical power.
- E. Operating System: Electrohydraulic.
- F. Microprocessor Control Unit: Solid-state controller.
- G. Features:
 - 1. Adjustable opening and closing speed.
 - 2. Adjustable opening and closing force.
 - 3. Adjustable backcheck.
 - 4. Adjustable hold-open time from zero to 30 seconds.
 - 5. Adjustable time delay.
 - 6. Adjustable acceleration.
 - 7. Obstruction recycle.
 - 8. On-off/hold-open switch to control electric power to operator.
- H. Activation Device:
 - 1. Push-plate switch on each side of door to activate door operator. As noted on Drawings.
 - 2. Exterior Type 302 Satin Stainless Steel Post. As noted on Drawings:
 - a. Recess Mount
 - b. 2" Diameter Post

- c. Direct Wired
- d. 42" High
- e. Stainless Steel Escutcheon Plate

- I. Safety Device: Infrared sensor mounted on door top rail to detect pedestrians in door swing to prevent door from closing.
- J. Exposed Finish: Custom powdercoat paint finish, color to match aluminum entrance framing system.

2.4 MATERIALS

- A. Aluminum: Alloy and temper recommended by manufacturer for type of use and finish indicated.
 - 1. Extrusions: ASTM B 221.
 - 2. Sheet: ASTM B 209.
- B. Stainless-Steel Sheet: ASTM A 240/A 240M or ASTM A 666, Type 304, stretcher-leveled standard of flatness, in manufacturer's standard thickness.
- C. Fasteners and Accessories: Corrosion-resistant, nonstaining, nonbleeding fasteners and accessories compatible with adjacent materials.

2.5 CONTROLS

- A. General: Provide controls, including activation and safety devices, according to BHMA standards; for condition of exposure; and for long-term, maintenance-free operation under normal traffic load for occupancy type indicated. Coordinate activation and safety devices with door operation and door operator mechanisms.
- B. Presence Sensors: Self-contained, active-infrared scanner units; adjustable to provide detection field sizes and functions required by BHMA A156.10. Sensors shall remain active at all times.
- C. Push-Plate Switch: Momentary-contact door control switch with flat push-plate actuator with contrasting-colored, engraved message.
 - 1. Configuration: Rectangular push plate with 2-by-4-inch junction box.
 - a. Mounting: As indicated on Drawings.
 - 2. Push-Plate Material: Stainless steel.
 - 3. Message: International symbol of accessibility and "Push to Open."

2.6 FABRICATION

- A. Factory fabricate automatic door operators to comply with indicated standards.
- B. Form aluminum shapes before finishing.
- C. Fabricate exterior components to drain condensation and water passing joints within operator enclosure to the exterior.

- D. Use concealed fasteners to greatest extent possible. Where exposed fasteners are required, use countersunk Phillips flat-head machine screws, finished to match operator.
- E. Provide metal cladding, completely covering visible surfaces before shipment to Project site. Fabricate cladding with concealed fasteners and connection devices, with accurately fitted joints with ends coped or mitered to produce hairline joints free of burrs and distortion, and with allowance for thermal expansion at exterior doors.

2.7 ACCESSORIES

- A. Signage: As required by cited BHMA standard for type of door and its operation.
 - 1. Application Process: Operator manufacturer's standard process.
 - 2. Provide sign materials with instructions for field application when operators are installed.

2.8 GENERAL FINISH REQUIREMENTS

- A. Protect mechanical finishes on exposed surfaces from damage by applying strippable, temporary protective covering before shipping.
- B. Apply organic and anodic finishes to formed metal after fabrication unless otherwise indicated.
- C. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within range of approved Samples and are assembled or installed to minimize contrast.

2.9 ALUMINUM FINISHES

- A. Clear Anodic Finish: AAMA 611, AA-M12C22A41, Class I, 0.018 mm or thicker.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine conditions, with Installer present, for compliance with requirements for installation tolerances, door and frame preparation and reinforcements, and other conditions affecting performance of automatic door operators.
- B. Examine roughing-in for electrical systems to verify actual locations of power connections before automatic door operator installation.
- C. Examine roughing-in for compressed-air piping systems to verify actual locations of piping connections before automatic door operator installation.
- D. Verify that full-height finger guards are installed at each door with pivot hinges where door has a clearance at hinge side greater than 1/4 inch and less than 3/4 inch with door in any position.
- E. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. General: Install automatic door operators according to manufacturer's written instructions and cited BHMA standard for type of door operation and direction of pedestrian travel, including signage, controls, wiring, remote power units if any, and connection to building's power supply.
 - 1. Do not install damaged components. Fit joints to produce hairline joints free of burrs and distortion.
 - 2. Install operators true in alignment with established lines and door geometry without warp or rack. Anchor securely in place.
- B. Controls: Install activation and safety devices according to manufacturer's written instructions and cited BHMA standard for operator type and direction of pedestrian travel. Connect control wiring according to Section 260519 "Low-Voltage Electrical Power Conductors and Cables."
- C. Signage: Apply on both sides of each door as required by cited BHMA standard for type of door operator and direction of pedestrian travel.

3.3 FIELD QUALITY CONTROL

- A. Certified Inspector: Engage a Certified Inspector to test and inspect components, assemblies, and installations, including connections.
- B. Perform the following tests and inspections with the assistance of a factory-authorized service representative:
 - 1. Test and inspect each automatic door operator installation, using AAADM inspection forms, to determine compliance of installed systems with applicable BHMA standards.
- C. Automatic door operators will be considered defective if they do not pass tests and inspections.
- D. Prepare test and inspection reports.

3.4 ADJUSTING

- A. Adjust automatic door operators to function smoothly, and lubricate as recommended by manufacturer; comply with requirements of applicable BHMA standards.
 - 1. Adjust operators on exterior doors for weathertight closure.
- B. After completing installation of automatic door operators, inspect exposed finishes on doors and operators. Repair damaged finish to match original finish.
- C. Readjust automatic door operators and controls after repeated operation of completed installation equivalent to three days' use by normal traffic (100 to 300 cycles).

3.5 DEMONSTRATION

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain automatic door operators.

3.6 AUTOMATIC DOOR OPERATORS SCHEDULE

- A. Listed in section 087111 hardware sets

END OF SECTION 087113

SECTION 088000 - GLAZING

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes glazing for the following products and applications, including those specified in other Sections where glazing requirements are specified by reference to this Section:
 - 1. Windows.
 - 2. Doors.
 - 3. Glazed entrances.
 - 4. Storefront framing.
 - 5. Spandrel Glass.

1.2 DEFINITIONS

- A. Manufacturer: A firm that produces primary glass or fabricated glass as defined in referenced glazing publications.
- B. Interspace: Space between lites of an insulating-glass unit that contains dehydrated air or a specified gas.
- C. Deterioration of Coated Glass: Defects developed from normal use that are attributed to the manufacturing process and not to causes other than glass breakage and practices for maintaining and cleaning coated glass contrary to manufacturer's written instructions. Defects include peeling, cracking, and other indications of deterioration in metallic coating.
- D. Deterioration of Laminated Glass: Defects developed from normal use that are attributed to the manufacturing process and not to causes other than glass breakage and practices for maintaining and cleaning laminated glass contrary to manufacturer's written instructions. Defects include edge separation, delamination materially obstructing vision through glass, and blemishes exceeding those allowed by referenced laminated-glass standard.
- E. Deterioration of Insulating Glass: Failure of the hermetic seal under normal use that is attributed to the manufacturing process and not to causes other than glass breakage and practices for maintaining and cleaning insulating glass contrary to manufacturer's written instructions. Evidence of failure is the obstruction of vision by dust, moisture, or film on interior surfaces of glass.

1.3 PERFORMANCE REQUIREMENTS

- A. General: Provide glazing systems capable of withstanding normal thermal movement and wind and impact loads (where applicable) without failure, including loss or glass breakage attributable to the following: defective manufacture, fabrication, and installation; failure of sealants or gaskets to remain watertight and airtight; deterioration of glazing materials; or other defects in construction.
- B. Glass Design: Glass thicknesses indicated are minimums and are for detailing only. Confirm glass thicknesses by analyzing Project loads and in-service conditions. Provide glass lites for various size openings in nominal thicknesses indicated, but not less than thicknesses and in strengths (annealed or heat treated) required to meet or exceed the following criteria:

1. Glass Thicknesses: Select minimum glass thicknesses to comply with ASTM E 1300, according to the following requirements:
 - a. Specified Design Wind Loads: Determine design wind loads applicable to Project from basic wind speed indicated in miles per hour (meters per second) at 33 feet (10 m) above grade, according to ASCE 7, "Minimum Design Loads for Buildings and Other Structures": Section 6.4.2, "Analytic Procedure," based on mean roof heights above grade indicated on Drawings.
 - b. Probability of Breakage for Vertical Glazing: 8 lites per 1000 for lites set vertically or not more than 15 degrees off vertical and under wind action.
 - 1) Load Duration: 60 seconds or less.
 - c. Maximum Lateral Deflection: For the following types of glass supported on all four edges, provide thickness required that limits center deflection at design wind pressure to 1/50 times the short side length or 1 inch (25 mm), whichever is less.
 - 1) For monolithic-glass lites heat treated to resist wind loads.
 - 2) For insulating glass.
 - 3) For laminated-glass lites.
 - d. Minimum Glass Thickness for Exterior Lites: Not less than 6 mm.
 - e. Thickness of Tinted and Heat-Absorbing Glass: Provide the same thickness for each tint color indicated throughout Project.
 - C. Thermal Movements: Provide glazing that allows for thermal movements resulting from the following maximum change (range) in ambient and surface temperatures acting on glass framing members and glazing components. Base engineering calculation on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.
 1. Temperature Change (Range): 180 deg F (100 deg C), material surfaces.
 - D. Thermal and Optical Performance Properties: Provide glass with performance properties specified based on manufacturer's published test data, as determined according to procedures indicated below:
 1. For monolithic-glass lites, properties are based on units with lites 6 mm thick.
 2. For insulating-glass units, properties are based on units with lites 6 mm thick and a nominal 1/2-inch- (13-mm-) wide interspace.
 3. Center-of-Glass U-Values: NFRC 100 methodology using LBL-35298 WINDOW 4.1 computer program, expressed as Btu/ sq. ft. x h x deg F (W/sq. m x K).
 4. Center-of-Glass Solar Heat Gain Coefficient: NFRC 200 methodology using LBL-35298 WINDOW 4.1 computer program.
 5. Solar Optical Properties: NFRC 300.
- 1.4 SUBMITTALS
- A. Samples: For the following products, in the form of 12-inch- (300-mm-) square Samples for glass.
 1. Each color of tinted float glass.
 2. Insulating glass for each designation indicated.
 3. For each color (except black) of exposed glazing sealant indicated.
 - B. 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.

- C. Product Certificates: Signed by manufacturers of glass and glazing products certifying that products furnished comply with requirements.
- D. Warranties: Special warranties specified in this Section.

1.5 QUALITY ASSURANCE

- A. 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.
- B. Source Limitations for Clear Glass: Obtain clear float glass from one primary-glass manufacturer.
- C. Source Limitations for Tinted Glass: Obtain tinted, heat-absorbing, and light-reducing float glass from one primary-glass manufacturer for each tint color indicated.
- D. Source Limitations for Coated Glass: Obtain coated glass from one manufacturer for each type of coating and each type and class of float glass indicated.
- E. Source Limitations for Insulating Glass: Obtain insulating-glass units from one manufacturer using the same type of glass and other components for each type of unit indicated.
- F. Source Limitations for Glazing Accessories: Obtain glazing accessories from one source for each product and installation method indicated.
- G. Preconstruction Adhesion and Compatibility Testing: Submit to elastomeric glazing sealant manufacturers, for testing indicated below, samples of each glass type, tape sealant, gasket, glazing accessory, and glass-framing member that will contact or affect elastomeric glazing sealants.
 - 1. Use manufacturer's standard test methods to determine whether priming and other specific preparation techniques are required to obtain rapid, optimum adhesion of glazing sealants to glass, tape sealants, gaskets, and glazing channel substrates.
 - a. Perform tests under normal environmental conditions replicating those that will exist during installation.
 - 2. Submit not fewer than nine pieces of each type and finish of glass-framing members and each type, class, kind, condition, and form of glass (monolithic, laminated, and insulating units) as well as one sample of each glazing accessory (gaskets, tape sealants, setting blocks, and spacers).
 - 3. Schedule sufficient time for testing and analyzing results to prevent delaying the Work.
 - 4. For materials failing tests, obtain sealant manufacturer's written instructions for corrective measures, including the use of specially formulated primers.
 - 5. Testing will not be required if elastomeric glazing sealant manufacturers submit data based on previous testing of current sealant products for adhesion to, and compatibility with, glazing materials matching those submitted.

- H. Safety Glass: Category II materials complying with testing requirements in 16 CFR 1201 and ANSI Z97.1.
 - 1. Subject to compliance with requirements, permanently mark safety glass with certification label of Safety Glazing Certification Council or another certification agency acceptable to authorities having jurisdiction.
- I. Glazing Publications: Comply with published recommendations of glass product manufacturers and organizations below, unless more stringent requirements are indicated. Refer to these publications for glazing terms not otherwise defined in this Section or in referenced standards.
 - 1. GANA Publications: GANA'S "Glazing Manual" and "Laminated Glass Design Guide."
- J. Insulating-Glass Certification Program: Permanently marked either on spacers or on at least one component lite of units with appropriate certification label of the following inspecting and testing agency:
 - 1. Insulating Glass Certification Council.
- K. Mockups: Before glazing, build mockups for each glass product indicated below to verify selections made under sample Submittals and to demonstrate aesthetic effects and qualities of materials and execution. Build mockups to comply with the following requirements, using materials indicated for the completed Work:
 - 1. Build mockups with the following kinds of glass to match glazing systems required for Project, including typical lite size, framing systems, and glazing methods:
 - a. Heat-strengthened coated glass.
 - b. Fully tempered glass.
 - c. Spandrel glass.
 - d. Coated insulating glass.
 - 2. Notify Architect seven days in advance of dates and times when mockups will be constructed.
 - 3. Obtain Architect's approval of mockups before starting fabrication.
 - 4. Maintain mockups during construction in an undisturbed condition as a standard for judging the completed Work.
 - 5. Demolish and remove mockups when directed.
 - 6. Approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.
- L. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Division 1 Section "Project Meetings."

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Protect glazing materials according to manufacturer's written instructions and as needed to prevent damage to glass and glazing materials from condensation, temperature changes, direct exposure to sun, or other causes.
- B. For insulating-glass units that will be exposed to substantial altitude changes, comply with insulating-glass manufacturer's written recommendations for venting and sealing to avoid hermetic seal ruptures.

1.7 PROJECT CONDITIONS

- A. Environmental Limitations: Do not proceed with glazing when ambient and substrate temperature conditions are outside limits permitted by glazing material manufacturers and when glazing channel substrates are wet from rain, frost, condensation, or other causes.
 - 1. Do not install liquid glazing sealants when ambient and substrate temperature conditions are outside limits permitted by glazing sealant manufacturer or below 40 deg F (4.4 deg C).

1.8 WARRANTY

- A. General Warranty: Special warranties specified in this Article shall not deprive Owner of other rights Owner may have under other provisions of the Contract Documents and shall be in addition to, and run concurrent with, other warranties made by Contractor under requirements of the Contract Documents.
- B. Manufacturer's Special Warranty on Coated-Glass Products: Written warranty, made out to Owner and signed by coated-glass manufacturer agreeing to furnish replacements for those coated-glass units that deteriorate as defined in "Definitions" Article, f.o.b. the nearest shipping point to Project site, within specified warranty period indicated below.
 - 1. Warranty Period: 10 years from date of Substantial Completion.
- C. Manufacturer's Special Warranty on Insulating Glass: Written warranty, made out to Owner and signed by insulating-glass manufacturer agreeing to furnish replacements for insulating-glass units that deteriorate as defined in "Definitions" Article, f.o.b. the nearest shipping point to Project site, within specified warranty period indicated below.
 - 1. Warranty Period: 10 years from date of Substantial Completion.
- D. ATTIC STOCK
 - 1. Where existing louvers systems are required to be installed to maintain mechanical system operations, provide individually tagged glass lites for each respective opening. Owner shall use these lites for infilling the framing opening once the louver is removed in a future phase.
 - 2. Package each individual lite in such a way as to protect from breakage. Clearly label each package with its intended location within the building.

PART 2 - PRODUCTS

2.1 PRODUCTS AND MANUFACTURERS

- A. Products: Subject to compliance with requirements, provide one of the products indicated in schedules at the end of Part 3.

2.2 PRIMARY FLOAT GLASS

- A. Float Glass: ASTM C 1036, Type I (transparent glass, flat), Quality q3 (glazing select); class as indicated in schedules at the end of Part 3.

2.3 HEAT-TREATED FLOAT GLASS

- A. Fabrication Process: By horizontal (roller-hearth) process with roll-wave distortion parallel to bottom edge of glass as installed, unless otherwise indicated.
- B. Heat-Treated Float Glass: ASTM C 1048; Type I (transparent glass, flat); Quality q3 (glazing select); class, kind, and condition as indicated in schedules at the end of Part 3.

2.4 INSULATING GLASS

- A. Insulating-Glass Units: Preassembled units consisting of sealed lites of glass separated by a dehydrated interspace, and complying with ASTM E 774 for Class CBA units and with requirements specified in this Article and in the Insulating-Glass Schedule at the end of Part 3.
 - 1. Provide Kind HS (heat-strengthened) float glass in place of annealed glass where needed to resist thermal stresses induced by differential shading of individual glass lites and to comply with glass design requirements specified in "Performance Requirements" Article. Provide Kind FT (fully tempered) where safety glass is indicated.
- B. Overall Unit Thickness and Thickness of Each Lite: Dimensions indicated in the Insulating-Glass Schedule at the end of Part 3 are nominal and the overall thicknesses of units are measured perpendicularly from outer surfaces of glass lites at unit's edge.
- C. Sealing System: Dual seal, with primary and secondary sealants as follows:
 - 1. Manufacturer's standard sealants.
- D. Spacer Specifications: Manufacturer's energy saving, warm edge spacer material and construction.
- E. Provide argon gas filled glazing units.

2.5 COATED SPANDREL FLOAT GLASS

- A. Float glass complying with requirements specified in monolithic glass schedules at the end of Part 3 and the following:
 - 1. Fallout Resistance: Provide spandrel units identical to those passing the fallout-resistance test for spandrel glass specified in ASTM C 1048.

2.6 ELASTOMERIC GLAZING SEALANTS

- A. General: Provide products of type indicated, complying with the following requirements:
 - 1. Compatibility: Select glazing sealants that are compatible with one another and with other materials they will contact, including glass products, seals of insulating-glass units, and glazing channel substrates, under conditions of service and application, as demonstrated by sealant manufacturer based on testing and field experience.

2. Suitability: Comply with sealant and glass manufacturers' written instructions for selecting glazing sealants suitable for applications indicated and for conditions existing at time of installation.
 3. Colors of Exposed Glazing Sealants: As selected by Architect from manufacturer's full range for this characteristic.
- B. Elastomeric Glazing Sealant Standard: Comply with ASTM C 920 and other requirements indicated for each liquid-applied, chemically curing sealant in the Glazing Sealant Schedule at the end of Part 3, including those referencing ASTM C 920 classifications for type, grade, class, and uses.
1. Additional Movement Capability: Where additional movement capability is specified in the Glazing Sealant Schedule, provide products with the capability, when tested for adhesion and cohesion under maximum cyclic movement per ASTM C 719, to withstand the specified percentage change in the joint width existing at time of installation and remain in compliance with other requirements in ASTM C 920 for uses indicated.

2.7 GLAZING TAPES

- A. Back-Bedding Mastic Glazing Tape: Preformed, butyl-based elastomeric tape with a solids content of 100 percent; nonstaining and nonmigrating in contact with nonporous surfaces; with or without spacer rod as recommended in writing by tape and glass manufacturers for application indicated; packaged on rolls with a release paper backing; and complying with ASTM C 1281 and AAMA 800 for products indicated below:
1. AAMA 804.3 tape, where indicated.
 2. AAMA 806.3 tape, for glazing applications in which tape is subject to continuous pressure.
 3. AAMA 807.3 tape, for glazing applications in which tape is not subject to continuous pressure.

2.8 GLAZING GASKETS

- A. Dense Compression Gaskets: Molded or extruded gaskets of material indicated below, complying with standards referenced with name of elastomer indicated below, and of profile and hardness required to maintain watertight seal:
1. Silicone, ASTM C 1115.
- B. Soft Compression Gaskets: Extruded or molded, closed-cell, integral-skinned gaskets of material indicated below; complying with ASTM C 509, Type II, black; and of profile and hardness required to maintain watertight seal:
1. Silicone.

2.9 MISCELLANEOUS GLAZING MATERIALS

- A. General: Provide products of material, size, and shape complying with referenced glazing standard, requirements of manufacturers of glass and other glazing materials for application indicated, and with a proven record of compatibility with surfaces contacted in installation.
- B. Cleaners, Primers, and Sealers: Types recommended by sealant or gasket manufacturer.
- C. Setting Blocks: 100% Silicone material with a Shore A durometer hardness of 85, plus or minus 5.

- D. Edge Blocks: Elastomeric material of hardness needed to limit glass lateral movement (side walking).
- E. Spacers: Provide manufacturer's energy saving warm-edge spacers.
- F. Cylindrical Glazing Sealant Backing: ASTM C 1330, Type O (open-cell material), of size and density to control glazing sealant depth and otherwise produce optimum glazing sealant performance.

2.10 FABRICATION OF GLASS AND OTHER GLAZING PRODUCTS

- A. Fabricate glass and other glazing products in sizes required to glaze openings indicated for Project, with edge and face clearances, edge and surface conditions, and bite complying with written instructions of product manufacturer and referenced glazing standard, to comply with system performance requirements.
- B. Clean-cut or flat-grind vertical edges of butt-glazed monolithic lites in a manner that produces square edges with slight kerfs at junctions with indoor and outdoor faces.
- C. Grind smooth and polish exposed glass edges.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine framing glazing, with Installer present, for compliance with the following:
 - 1. Manufacturing and installation tolerances, including those for size, squareness, and offsets at corners.
 - 2. Presence and functioning of weep system.
 - 3. Minimum required face or edge clearances.
 - 4. Effective sealing between joints of glass-framing members.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Clean glazing channels and other framing members receiving glass immediately before glazing. Remove coatings not firmly bonded to substrates.

3.3 GLAZING, GENERAL

- A. Comply with combined written instructions of manufacturers of glass, sealants, gaskets, and other glazing materials, unless more stringent requirements are indicated, including those in referenced glazing publications.
- B. Glazing channel dimensions, as indicated on Drawings, provide necessary bite on glass, minimum edge and face clearances, and adequate sealant thicknesses, with reasonable tolerances. Adjust as required by Project conditions during installation.
- C. Protect glass edges from damage during handling and installation. Remove damaged glass from Project site and legally dispose of off Project site. Damaged glass is glass with edge damage or other imperfections that, when installed, could weaken glass and impair performance and appearance.

- D. Apply primers to joint surfaces where required for adhesion of sealants, as determined by preconstruction sealant-substrate testing.
- E. Install setting blocks in sill rabbets, sized and located to comply with referenced glazing publications, unless otherwise required by glass manufacturer. Set blocks in thin course of compatible sealant suitable for heel bead.
- F. Do not exceed edge pressures stipulated by glass manufacturers for installing glass lites.
- G. Provide spacers for glass lites where the length plus width is larger than 50 inches (1270 mm) as follows:
 - 1. Locate spacers directly opposite each other on both inside and outside faces of glass. Install correct size and spacing to preserve required face clearances, unless gaskets and glazing tapes are used that have demonstrated ability to maintain required face clearances and to comply with system performance requirements.
 - 2. Provide 1/8-inch (3-mm) minimum bite of spacers on glass and use thickness equal to sealant width. With glazing tape, use thickness slightly less than final compressed thickness of tape.
- H. Provide edge blocking where indicated or needed to prevent glass lites from moving sideways in glazing channel, as recommended in writing by glass manufacturer and according to requirements in referenced glazing publications.
- I. Set glass lites in each series with uniform pattern, draw, bow, and similar characteristics.
- J. Where wedge-shaped gaskets are driven into one side of channel to pressurize sealant or gasket on opposite side, provide adequate anchorage so gasket cannot walk out when installation is subjected to movement.
- K. Square cut wedge-shaped gaskets at corners and install gaskets in a manner recommended by gasket manufacturer to prevent corners from pulling away; seal corner joints and butt joints with sealant recommended by gasket manufacturer.

3.4 TAPE GLAZING

- A. Position tapes on fixed stops so that, when compressed by glass, their exposed edges are flush with or protrude slightly above sightline of stops.
- B. Install tapes continuously, but not necessarily in one continuous length. Do not stretch tapes to make them fit opening.
- C. Where framing joints are vertical, cover these joints by applying tapes to heads and sills first and then to jambs. Where framing joints are horizontal, cover these joints by applying tapes to jambs and then to heads and sills.
- D. Place joints in tapes at corners of opening with adjoining lengths butted together, not lapped. Seal joints in tapes with compatible sealant approved by tape manufacturer.
- E. Do not remove release paper from tape until just before each glazing unit is installed.
- F. Apply heel bead of elastomeric sealant.

- G. Center glass lites in openings on setting blocks and press firmly against tape by inserting dense compression gaskets formed and installed to lock in place against faces of removable stops. Start gasket applications at corners and work toward centers of openings.
- H. Apply cap bead of elastomeric sealant over exposed edge of tape.

3.5 GASKET GLAZING (DRY)

- A. Fabricate compression gaskets in lengths recommended by gasket manufacturer to fit openings exactly, with stretch allowance during installation.
- B. Insert soft compression gasket between glass and frame or fixed stop so it is securely in place with joints miter cut and bonded together at corners.
- C. Center glass lites in openings on setting blocks and press firmly against soft compression gasket by inserting dense compression gaskets formed and installed to lock in place against faces of removable stops. Start gasket applications at corners and work toward centers of openings. Compress gaskets to produce a weathertight seal without developing bending stresses in glass. Seal gasket joints with sealant recommended by gasket manufacturer.
- D. Install gaskets so they protrude past face of glazing stops.

3.6 SEALANT GLAZING (WET)

- A. Install continuous spacers, or spacers combined with cylindrical sealant backing, between glass lites and glazing stops to maintain glass face clearances and to prevent sealant from extruding into glass channel and blocking weep systems until sealants cure. Secure spacers or spacers and backings in place and in position to control depth of installed sealant relative to edge clearance for optimum sealant performance.
- B. Force sealants into glazing channels to eliminate voids and to ensure complete wetting or bond of sealant to glass and channel surfaces.
- C. Tool exposed surfaces of sealants to provide a substantial wash away from glass.

3.7 PROTECTION AND CLEANING

- A. Protect exterior 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.
- 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. Examine glass surfaces adjacent to or below exterior concrete and other masonry surfaces at frequent intervals during construction, but not less than once a month, for build-up of dirt, scum, alkaline deposits, or stains; remove as recommended by glass manufacturer.
- D. Remove and replace glass that is broken, chipped, cracked, abraded, or damaged in any way, including natural causes, accidents, and vandalism, during construction period.

- E. 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.

3.8 MONOLITHIC FLOAT-GLASS SCHEDULE

- A. Uncoated Clear Float Glass: Where glass as designated below is indicated, provide Type I (transparent glass, flat), Class 1 (clear) glass lites complying with the following:
 - 1. Uncoated Clear Fully Tempered Float Glass: Kind FT (fully tempered).

3.9 INSULATING-GLASS SCHEDULE

- A. VISION: 1" Low-E 2nd Surface, Argon filled.
 - 1. Properties
 - a. Visible light transmittance: 70%
 - b. Visible reflectance out: 11%
 - c. Visible reflectance in: 12%
 - d. UV Transmittance: 25%
 - e. LSG ratio 1.79
 - f. U-value: .29 winter
 - g. Solar Heat Gain Coefficient: 0.39
- B. Provide this glazing for all exterior aluminum storefront framing systems.
- C. MANUFACTURERS
 - 1. Viracon
 - 2. Guardian Glass
 - 3. Vitro Architectural Glass – Solarban 60 (Basis of Design)
- D. SPANDREL: Provide insulated spandrel glazing matching exterior appearance of vision glass.
 - 1. Manufacturers:
 - a. Provide the specified Basis of Design products.
 - b. Provide spandrel panels where indicated and where backed up by opaque wall systems.

3.10 GLAZING SEALANT SCHEDULE

- A. Medium-Modulus Neutral-Curing Silicone Glazing Sealant GS-#: Where glazing sealants of this designation are indicated, provide products complying with the following:
1. Products: Provide one of the following:
 - a. 756 H.P.; Dow Corning.
 - b. Silglaze II; GE Silicones.
 - c. 895; Pecora Corporation.
 2. Type and Grade: S (single component) and NS (nonsag).
 3. Class: 25.
 4. Additional Movement Capability: 50 percent movement in extension and 50 percent movement in compression for a total of 100 percent movement.
 5. Use Related to Exposure: NT (nontraffic)
 6. Uses Related to Glazing Substrates: G, A, and, as applicable to glazing substrates indicated, O.

END OF SECTION 088000

9

DIVISION

FINISHES

SECTION 099113 - EXTERIOR PAINTING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section includes surface preparation and the application of paint systems on the following exterior substrates:
 - 1. Concrete.
 - 2. Concrete masonry units (CMU).
 - 3. Exterior portland cement plaster (soffit / window heads).
 - 4. Ferrous metals / Galvanized Metals

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product. Include preparation requirements and application instructions.
- B. Samples for Initial Selection: For each type of topcoat product.
- C. Samples for Verification: For each type of paint system and each color and gloss of topcoat.
 - 1. Submit Samples on rigid backing, 8 inch square.

1.4 CLOSEOUT SUBMITTALS

- A. Coating Maintenance Manual: Provide coating maintenance manual including area summary with finish schedule, area detail designating location where each product/color/finish was used, product data pages, material safety data sheets, care and cleaning instructions, touch-up procedures, and color samples of each color and finish used.

1.5 MAINTENANCE MATERIAL SUBMITTALS

- A. Provide leftover materials from the same product run, that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1.6 QUALITY ASSURANCE

- A. Mockups: Apply mockups of each paint system indicated and each color and finish selected to verify preliminary selections made under Sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.

1. Architect will select one surface to represent surfaces and conditions for application of each paint system specified in Part 3.
 - a. If preliminary color selections are not approved, apply additional mockups of additional colors selected by Architect at no added cost to Owner.
2. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
3. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Delivery and Handling: Deliver products to Project site in an undamaged condition in manufacturer's original sealed containers, complete with labels and instructions for handling, storing, unpacking, protecting, and installing. Packaging shall bear the manufacture's label with the following information:
 1. Product name and type (description).
 2. Batch date.
 3. Color number.
 4. VOC content.
 5. Environmental handling requirements.
 6. Surface preparation requirements.
 7. Application instructions.
- B. Store materials not in use in tightly covered containers in well-ventilated areas with ambient temperatures continuously maintained at not less than 45 deg F.
 1. Maintain containers in clean condition, free of foreign materials and residue.
 2. Remove rags and waste from storage areas daily.

1.8 FIELD CONDITIONS

- A. Apply paints only when temperature of surfaces to be painted and ambient air temperatures are between 50 and 95 deg F.
- B. Do not apply paints in snow, rain, fog, or mist; when relative humidity exceeds 85 percent; at temperatures less than 5 deg F above the dew point; or to damp or wet surfaces.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Basis-of-Design Product: Subject to compliance with requirements, provide Sherwin-Williams Company (The); products indicated.
- B. Source Limitations: Obtain paint materials from single source from single listed manufacturer.

1. Manufacturer's designations listed on a separate color schedule are for color reference only and do not indicate prior approval.

2.2 PAINT, GENERAL

A. Material Compatibility:

1. Provide materials for use within each paint system that are compatible with one another and substrates indicated, under conditions of service and application as demonstrated by manufacturer, based on testing and field experience.
2. For each coat in a paint system, provide products recommended in writing by manufacturers of topcoat for use in paint system and on substrate indicated.

B. Colors: As selected by Architect from manufacturer's full range.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions, with Applicator present, for compliance with requirements for maximum moisture content and other conditions affecting performance of the Work. Verify suitability of substrates, including surface conditions and compatibility with existing finishes and primers. Where acceptability of substrate conditions is in question, apply samples and perform in-situ testing to verify compatibility, adhesion, and film integrity of new paint application.

1. Report, in writing, conditions that may affect application, appearance, or performance of paint.

B. Substrate Conditions:

1. Maximum Moisture Content of Substrates: When measured with an electronic moisture meter as follows:
 - a. Concrete: 12 percent.
 - b. Masonry (Clay and CMU): 12 percent.
 - c. Portland Cement Plaster: 12 percent.
2. Portland Cement Plaster Substrates: Verify that plaster is fully cured.

C. Proceed with coating application only after unsatisfactory conditions have been corrected; application of coating indicates acceptance of surfaces and conditions.

3.2 PREPARATION

A. Comply with manufacturer's written instructions and recommendations in "MPI Manual" applicable to substrates and paint systems indicated.

B. Remove hardware, covers, plates, and similar items already in place that are removable and are not to be painted. If removal is impractical or impossible because of size or weight of item, provide surface-applied protection before surface preparation and painting.

1. After completing painting operations, use workers skilled in the trades involved to reinstall items that were removed. Remove surface-applied protection.
- C. Clean substrates of substances that could impair bond of paints, including dust, dirt, oil, grease, and incompatible paints and encapsulants.
1. Remove incompatible primers and reprime substrate with compatible primers or apply tie coat as required to produce paint systems indicated.
- D. Concrete Substrates: Remove release agents, curing compounds, efflorescence, and chalk. Do not paint surfaces if moisture content or alkalinity of surfaces to be painted exceeds that permitted in manufacturer's written instructions.
- E. Masonry Substrates: Remove efflorescence and chalk. Do not paint surfaces if moisture content or alkalinity of surfaces or mortar joints exceeds that permitted in manufacturer's written instructions.

3.3 APPLICATION

- A. Apply paints according to manufacturer's written instructions and recommendations in "MPI Manual."
1. Use applicators and techniques suited for paint and substrate indicated.
 2. Paint surfaces behind movable items same as similar exposed surfaces. Before final installation, paint surfaces behind permanently fixed items with prime coat only.
 3. Paint both sides and edges of exterior doors and entire exposed surface of exterior door frames.
- B. Tint undercoats same color as topcoat, but tint each undercoat a lighter shade to facilitate identification of each coat if multiple coats of same material are to be applied. Provide sufficient difference in shade of undercoats to distinguish each separate coat.
- C. If undercoats or other conditions show through topcoat, apply additional coats until cured film has a uniform paint finish, color, and appearance.
- D. Apply paints to produce surface films without cloudiness, spotting, holidays, laps, brush marks, roller tracking, runs, sags, ropiness, or other surface imperfections. Cut in sharp lines and color breaks.

3.4 FIELD QUALITY CONTROL

- A. Dry Film Thickness Testing: Owner may engage the services of a qualified testing and inspecting agency to inspect and test paint for dry film thickness.
1. Contractor shall touch up and restore painted surfaces damaged by testing.
 2. If test results show that dry film thickness of applied paint does not comply with paint manufacturer's written recommendations, Contractor shall pay for testing and apply additional coats as needed to provide dry film thickness that complies with paint manufacturer's written recommendations.

3.5 CLEANING AND PROTECTION

- A. At end of each workday, remove rubbish, empty cans, rags, and other discarded materials from Project site.

- B. After completing paint application, clean spattered surfaces. Remove spattered paints by washing, scraping, or other methods. Do not scratch or damage adjacent finished surfaces.
- C. Protect work of other trades against damage from paint application. Correct damage to work of other trades by cleaning, repairing, replacing, and refinishing, as approved by Architect, and leave in an undamaged condition.
- D. At completion of construction activities of other trades, touch up and restore damaged or defaced painted surfaces.

3.6 EXTERIOR PAINTING SCHEDULE

A. Concrete, Clay Masonry, Portland Cement Plaster (Stucco)

1. Latex System:

a. Prime Coat: 100% Solids Acrylic Emulsion Conditioner

- 1) S-W Loxon Acrylic Conditioner (LX03W0100)
- 2) Apply number of coats recommended by manufacturer for substrates indicated.

b. Topcoat: Waterproofing Masonry Coating

- 1) S-W Loxon XP (LX11S0053)
- 2) 14 mils wet, 8.4 mils dry per coat
- 3) Two coats.

B. Ferrous Metal, Galvanized-Metal:

1. Water-Based Light Industrial Coating System:

a. Prime Coat: Primer, water based.

- 1) S-W Pro Industrial Pro-Cryl Universal Primer, B66-310 Series, 5.0 to 10.0 mils wet, 2.0 to 4.0 dry.

b. Intermediate Coat: Light industrial coating, exterior, water based, matching topcoat.

c. Topcoat: Light industrial coating, exterior, water based, semi-gloss.

- 1) S-W Pro Industrial Acrylic Semi-Gloss Coating, B66-650 Series, at 2.5 to 4.0 mils dry, per coat.

END OF SECTION 099113

SECTION 099726 – SILICATE COATINGS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes: The work specified in this Section includes an application of a long-lasting decorative coating system for mineral-based surfaces providing strong weathering protection. The application comprises a silicate “grob” base coat that fills hairline cracks and crazing or for equalizing repairs or rough substrate followed with a silicate top coat. Coating may be sprayed, rolled, or brushed in good weather before surfaces are heated up by direct sunlight. Specification does not include surface preparation.

1.3 REFERENCES

- A. General: The publications listed below form a part of this Specification to the extent referenced. The publications are referred to in the text by the basic designation only.
- B. ASTM (ASTM):
 - 1. ASTM E 96, "Standard Test Methods for Water Vapor Transmission of Materials."
 - 2. ASTM E 514, "Standard Test Method for Water Penetration and Leakage Through Masonry."
 - 3. ASTM G 154, "Standard Practice for Operating Fluorescent Light Apparatus for UV Exposure of Nonmetallic Materials."
 - 4. ASTM E84-05, "Standard Test Method for Surface Burning Characteristics of Building Materials."

1.4 DEFINITIONS

- A. Silicate coating grob base coat: The first applied coat of the silicate coating.
- B. Silicate coating, top coat: The second applied coat of the silicate coating.
- C. Dilution: A silicate based diluent used to thin the silicate grob base coat.

1.5 SYSTEM DESCRIPTION

- A. A materials-compatible highly vapor permeable decorative coating system offering severe weathering protection for exterior exposure. Install over mineral surfaces.

1. Silicate Grob Coating: An incombustible two coat system with UV and alkaline resistant inorganic pigments in the specified color. Coatings penetrate the surface to chemically react with the substrate, resulting in both covalent and mechanical bonds with a hard amorphous microporous structure with extremely high vapor permeability that is unaffected by acids, UV exposure, or air-borne pollutants. Provides weathering protection without reducing substrate vapor permeability.

1.6 ACTION SUBMITTALS

- A. Product Data: Submit product data showing material proposed. Submit sufficient information to determine compliance with the Drawings and Specifications. Provide published documentation describing materials, characteristics, and limitations.
- B. Samples:
 1. Submit samples for initial color selection. Submit samples of each specified finish. Submit samples in form of manufacturer's color charts showing full range of colors and finishes available. Where finishes involve normal color variations, include samples showing the full range of variations expected.
 2. Manufacturer's Instructions: Submit manufacturer's instructions including technical data sheets, material safety data sheets, mixing instructions, application requirements, special procedures, and conditions requiring special attention.

1.7 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Provide evidence that Manufacturer is a firm engaged in the manufacture of silicate coatings of types required, and whose products have been in satisfactory use in similar service for a minimum of 20 years.
- B. Applicator Qualifications: Provide evidence Applicator is a firm having a minimum of three years of successful application experience with projects similar in type and scope to that required for this Project, and approved by the manufacturer.
- C. Mock-Ups: Prior to application of the work, fabricate and erect mock-ups for each type of finish and application required to verify selections made under sample submittals and to demonstrate aesthetic effects as well as qualities of materials and execution. Build mock-ups to comply with the following requirements, using materials indicated for final unit of work. Locate mock-ups on site in location and of size indicated or, if not indicated, as directed by the Architect. Demonstrate the proposed range of aesthetic effects and workmanship to be expected in the completed work. Obtain the Architect's acceptance of mock-ups before start of final unit of work.
 1. Accepted mock-ups in undisturbed condition at time of Substantial Completion may become part of completed unit of work.

1.8 WARRANTY

- A. Special Warranty: Contractor warrants the work of this Section to be in accordance with the Contract Documents and free from faults and defects in materials and workmanship for the period indicated below. Provide a special warranty extending the one year period of limitations contained in the General Conditions countersigned by the Applicator and the manufacturer.
 1. Warranty Period: Warranty period from date of Substantial Completion is 10 years.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Basis of Design: Items specified are to establish a standard of quality for design, function, materials, compatibility, warranty, and appearance. Equivalent products by listed manufacturers are acceptable. The Architect is the sole judge of the basis of what is equivalent.
1. KEIM Mineral Coatings of America, Inc., 10616 Texland Blvd. #600, Charlotte, North Carolina 28273. Local representation: Speccrete; Speccrete.com
- B. Equivalent products from the following, complying with requirements of this section.
1. Beeck Mineral Paints; 8161 Regent Parkway, #101, Fort Mill, SC 29715-8405: info@beeckmineralpaints.com.

2.2 MATERIALS

- A. Silicate Coating, Grob Base Coat: Provide silicate based opaque grob coating conforming to DIN 18.363/2.4.1, without biocides, and less than 1g/l VOC. Meets Non-flammable standard DIN 4102-A2. ASTM E 96 Vapor Permeability – 83 perms, ASTM G 154 Accelerated Weathering – no fading, cracking, peeling, ASTM E 514 62-MPH Wind-Driven Rain Test – no water penetration.
1. Basis of Design: “KEIM Granital Grob”, KEIM Mineral Coatings of America, Inc.
- B. Silicate Coating, Top Coat: Provide silicate based opaque coating conforming to DIN 18.363/2.4.1, without biocides, and less than 1g/l VOC. Meets Non-flammable standard DIN 4102-A2. ASTM E 96 Vapor Permeability – 83 perms, ASTM G 154 Accelerated Weathering – no fading, cracking, peeling, ASTM E 514 62-MPH Wind-Driven Rain Test – no water penetration.
1. Basis of Design: “KEIM Granital”, KEIM Mineral Coatings of America, Inc.
- C. Dilution for Silicate Coating: Provide silicate dilution that is designed for the silicate coating system. Meets Non-flammable standard DIN 4102-A2. Less than 1g/l VOC.
1. Basis of Design: “KEIM Granital Dilution”, KEIM Mineral Coatings of America, Inc.

2.3 EQUIPMENT

- A. Tools:
1. Silicate Coating, Grob Base Coat: Apply by natural bristle façade brush, professional roller, or professional airless spray equipment and back-roll as required for even distribution.
 2. Silicate Coating, Top Coat: Apply by natural bristle façade brush, professional roller, or professional airless spray equipment and back-roll as required for even distribution.

2.4 FINISHES

- A. Silicate Coating; Grob Base and Top Coats: Apply evenly to a smooth mineral matte finish without voids, “holidays”, or drips.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verification of Conditions: Examine areas and conditions under which the work is to be applied, and notify the Contractor in writing, with a copy to the Owner and the Architect, of any conditions detrimental to the proper and timely completion of the work. Do not proceed with the work until unsatisfactory conditions have been corrected.
 - 1. Verify substrate is secure, sound, dry, and absorbent, and free of dirt, grease, salts, oil-based paints, release agents, curing agents, and other bond breakers.
 - 2. Verify substrate has no pretreatments or priming materials applied.
 - 3. Verify materials to be coated are fully cured to manufacturer recommendations.
 - 4. Beginning of the work shall indicate acceptance of the areas and conditions as satisfactory by the Applicator.

3.2 PREPARATION

- A. Protection: Lay ground cloths and take measures as necessary to protect surfaces subject to contact by products specified by this Section.
- B. Substrate: Prepare using products or materials described in the MATERIALS Article.

3.3 APPLICATION

- A. Conform to reviewed product data, manufacturer's written instructions, and provisions of the Contract Documents.
- B. Plan the work properly.
 - 1. Work ahead of the sun on shaded façades.
 - 2. Work to logical stopping points (corners, seams, architectural features, etc.).
 - 3. Apply coatings maintaining a wet edge to desired finish as indicated in FINISHES Article.
 - 4. Protect from wind and rain prior to, during, and for a minimum 24 hours after application.
- C. Silicate Coating:
 - 1. Base Coat: Dilute silicate grob coating with 5 percent dilution (25kg with 1.25 liters dilution). Stir well by hand or 600-800 RPM mixing equipment.
 - a. Apply base coat of diluted silicate coating.
 - b. Allow minimum 12 hours drying time.

- D. Top Coat: Apply silicate coating undiluted. Stir well by hand or 600-800 RPM mixing equipment.
 - a. Apply top coat of undiluted silicate coating.

3.4 FIELD QUALITY CONTROL

- A. Testing: The Owner reserves the right to invoke test procedures at any time and as often as the Owner deems necessary during the period when coatings are being applied. Tests include, but are not limited to, material analysis and coating thickness.
 - 1. The Owner may engage the services of an independent inspecting and testing agency to sample the material being used. Samples of material delivered to the Project may be taken, identified, sealed, and certified in the presence of the Contractor.
 - 2. The inspecting and testing agency will perform appropriate tests for listed characteristics as required by the Owner.
 - 3. The Owner may direct the Contractor to stop the work if test results show material being used does not comply with specified requirements. The Contractor is responsible to remove non-complying product from the site, pay for testing, and recoat surfaces previously coated with the rejected material. If necessary, the Contractor may be required to remove rejected material from previously coated surfaces if, on recoating with specified material, the two coatings are incompatible.
- B. Repairs: Correct deficiencies in or remove work that does not comply with requirements, repair substrates, and reapply coating.
- C. Additional Testing: Additional testing performed to determine compliance of corrected work with requirements shall be at the Contractor's expense.

3.5 CLEANING

- A. Clean tools, spills, and accidental drips immediately with plenty of water.
- B. Leave applications clean and premises free from residue and debris from work of this Section.

3.6 PROTECTION

- A. Provide final protection and maintain conditions in a manner acceptable to the Applicator to ensure silicate coatings are without damage at time of Substantial Completion.

END OF SECTION 099726

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DIVISION

FURNISHINGS

SECTION 124813 – ENTRANCE FLOOR TILE

PART 1 – GENERAL

1.1 SUMMARY

- A. Section includes: Entrance floor tile

1.2 REFERENCE STANDARDS

- A. ASTM International,
1. D 2859 Standard Test Method for Ignition Characteristics of Finished Textile Floor Covering Materials
 2. E 662 Standard Test Method for Specific Optical Density of Smoke Generated by Solid Materials
- B. DIN Standard
1. DIN 52612 Determination of Thermal Conductivity by the Guarded Hot Plate Apparatus
- C. International Standards Organization (ISO)
1. ISO 105 B02 Colour fastness to artificial light: Xenon arc fading lamp test
 2. ISO 105 E01 Colour fastness to water
 3. ISO 105 x12 Colour fastness to rubbing
 4. ISO 140-8 Acoustics: Measurement of Sound Insulation in Buildings and of Building Elements
 5. ISO 6356 Textile floor coverings. Assessment of static electrical propensity – walking test
- D. Other referenced documents
1. Consumer Products Safety Commission (CPSC) FF 1-70: Pill Test
 2. Department of Commerce (DOC) FF 1-70: Pill Test
 3. LEED-NC v. 3

1.3 ADMINISTRATIVE REQUIREMENTS

- A. Coordination: Install entrance matting after finishing operations, including painting and ceiling operations, have been completed.
- B. Pre-installation Meetings: Meet to confirm project requirements, substrate conditions, manufacturer's installation instructions and warranty requirements in compliance with Division 1 requirements.

1.4 ACTION SUBMITTALS

- A. General: Submit listed submittals in accordance with Conditions of the Contract and Division 1 Submittal Procedures.
- B. Product Data: For specified products, submit latest edition of product supplier's technical specifications data (available from www.connexusflooring.com).
- C. Shop Drawings: Submit shop drawings showing layout, profiles, and product components.
- D. Samples: Submit selection and verification samples showing the required finishes, colors, designs, and textures for flooring, as well as samples of adhesives and applicable accessories such as nosing, frames, etc.

1.5 INFORMATION SUBMITTALS

A. Test and Evaluation Reports

1. Product test reports: As required by Conditions of the Contract and Division 1 Regulatory Requirements Section, submit test certificates from an independent test laboratory showing compliance with specified performance characteristics and physical properties.
2. Compatibility and adhesion test reports: Submit test reports confirming adhesive's effectiveness with the product(s) specified.

B. Manufacturer Instructions: For specified products, submit latest editions of product supplier's installation and cleaning & maintenance instructions (available from www.connexusflooring.com).

1.6 CLOSEOUT SUBMITTALS

A. Warranty documentation: For specified products and accessories, submit product supplier's warranty documents (available from www.connexusflooring.com).

B. Attic stock: 1 sealed carton of tiles.

1.7 QUALITY ASSURANCE

A. Installer: Installer shall be highly experienced in performing work of this section, having previous done fiber roll goods installation work similar to that required for this project.

B. Testing Agency: Agency(ies) shall be independent and qualified to perform the specified product tests.

1.8 DELIVERY, STORAGE, AND HANDLING

A. General: Comply with Division 1 Product Requirements Section

B. Delivery and Acceptance Requirements: Comply with the product supplier's ordering and lead time requirements to avoid construction delays, and to allow material to acclimatize as required in the specified product's installation instructions. Accept delivery of materials only if they are in unopened, undamaged packaging that bears the name and brand of the manufacturer/product supplier, project identification, and shipping and handling instructions.

C. Storage and Handling Requirements: Store material -- including any adhesive and accessories -- in the original packaging (as delivered) in areas that are enclosed and weather tight with the permanent HVAC system set at a temperature of between 65°F and 80°F for a minimum of 48 hours prior to commencement of installation. In addition, comply with storage and handling requirements listed on product packaging, and described in the latest edition of the product's installation instructions (available from www.connexusflooring.com).

1.9 AMBIENT SITE CONDITIONS

The permanent HVAC system shall be operational and set at a temperature of between 65°F and 80°F for a minimum of 48 hours prior to commencement of installation, during the time of installation, and for 48 hours after installation has been completed. Thereafter, minimum temperature shall be 55°F.

PART 2 – PRODUCTS

2.1 MANUFACTURERS

- A. Supplier: connexus, 37 Shuman Ave, Stoughton, MA 02072; telephone: 1.781.573.0202; fax: 1.781.344.1537; website: www.connexusflooring.com.
- B. Substitutions: Acceptable Manufacturer’s and Products
 - 1. Tarkett: Clean Path carpet tile
 - 2. Mohawk Group: Step Up II tile
 - 3. Submit substitution requests as outlined in Division 01
- C. Product: Super Nop 52 Tile
 - Construction: 100% Asota® solution-dyed UV stabilized polypropylene fibers
 - Tile size: 19 11/16” x 19 11/16” square
 - Case pack: 12 tiles per case (32.4 square feet)
 - Thickness: 3/8”
 - Weight: 141 ounces/square yard
 - Colors: As selected by Architect from manufacturer’s full product range
- D. Performance: Physical properties of the entrance matting shall conform to the following minimums:

Super Nop 52 Tile

Safety

Surface flammability	ASTM D2859	Pass (equal to CPSC FF 1-70 and DOC FF 1-70)
Smoke Density	ASTM E662	Pass

Performance

Static electrical propensity	ISO 6356: < 2 kV	
Sound absorption	ISO 140-8: 29 dB	
Color fastness to light	ISO 105 B02: 6	Color
fastness to water	ISO 105 E01: 5	Color
fastness to rubbing	ISO 105 X 12: 4	Thermal
resistance	DIN 52612: 0.09 m2K/W	<u>LEED</u>
IEQ Credit 4.1	Release-Bond VOC: 0 g/L	
IEQ Credit 4.3	Super Nop Tile is Green Label Plus certified.	IEQ
Credit 5	Super Nop 52 Tile is designed for semi-permanent installation	

2.2 ACCESSORY PRODUCTS

- A. Adhesive: Architect to specify adhesive and trowel notch size per the latest edition of the installation instructions (available from www.connexusflooring.com).

PART 3 – EXECUTION

3.1 EXAMINATION

- A. Overall: Follow guidelines laid out in Division 01, Section 01 71 00 – Examination and Preparation as well as Section 01 43 00 – Quality Assurance.
- B. Verification of Conditions: Subfloors shall be clean and dry. Inspect all substrates and subfloors for proper tolerances, and report any discrepancies to the general contractor in writing.

- C. Preinstallation Measurements: Verify actual measurement by field measuring before any onsite cutting, if applicable. To avoid construction delays, coordinate field measurements based upon construction progress.
 - D. Evaluation and Assessment: See the state requirements for the project location.
- 3.2 SURFACE PREPARATION
- A. Follow guidelines laid out in Division 01, Section 01 71 00 – Examination and Preparation.
 - B. Concrete subfloors: Where concrete subfloors are present, all work required to put the concrete subfloor in acceptable condition shall be the responsibility of the general contractor. See the state requirements for the project location.
- 3.3 INSTALLATION
- A. Follow Division 01 relevant guidelines, and the latest edition of the manufacturer’s installation instructions (available from www.connexusflooring.com)
 - B. Interface with Other Work: If transitions are required to and/or from the specified entrance matting, contact connexus for suitable transition material.
 - C. Sizes: Where not indicated otherwise, provide single unit for each mat installation, but do not exceed manufacturer's maximum size recommendation for units intended for removal and cleaning. Where possible, verify sizes by field measurement before shop fabrication.
 - D. Accessory selection: Where indicated for recessed or wall-to-wall applications provide aluminum framework as recommended by manufacturer. Where indicated for surface-mounted applications, provide tapered vinyl moldings with flanges sewn to back of mat on all four sides with mitered corners.
- 3.4 CLEANING
- A. General: Clean up job site, including sweeping or dust mopping the floor to remove all dirt or grit, and put all waste in general contractor’s dumpster. Follow overall cleaning guidelines described in Division 01.
 - B. Initial Maintenance: Conduct a full initial maintenance following the latest edition of the manufacturer’s maintenance instructions (available from www.connexusflooring.com). Instruct owner’s cleaning staff in proper maintenance procedures.
- 3.5 CLOSEOUT ACTIVITIES
- A. Provide attic stock material as specified.

END OF SECTION 124813

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DIVISION

ELECTRICAL

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DIVISION 26 – ELECTRICAL

SECTION 260501 - GENERAL PROVISIONS - ELECTRICAL

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General, Special, and Supplementary Conditions, and Divisions 00 and 01 Specification Sections, apply to this Section.
- B. The Instructions to Bidders, General and Special Conditions, and all other contract documents shall apply to the Contractor's work as well as to each of his Sub Contractor's work. Each Contractor is directed to familiarize himself in detail with all documents pertinent to this Contract. In case of conflict between these General Provisions and the General and/or Special Conditions, the affected Contractor shall contact the Engineer for clarification and final determination.
- C. Each Contractor shall be governed by any alternates, unit prices and Addenda or other contract documents insofar as they may affect his part of the work.

1.2 SUMMARY

- A. The work included in this division consists of the furnishing of all labor, equipment, transportation, supplies, material and appurtenances and performing all operations necessary for the satisfactory installation of complete and operating Electrical Systems indicated on the drawings and/or specified herein.
- B. Any materials, labor, equipment or services not mentioned specifically herein which may be necessary to complete or perfect any part of the Electrical Systems in a substantial manner, in compliance with the requirements stated, implied, or intended in the drawings and specifications, shall be included as part of this Contract. The Contractor shall give written notice of any materials or apparatus believed inadequate or unsuitable; in violation of laws, ordinances, rules or regulations of authorities having jurisdiction; and any necessary items of work omitted a minimum of ten days prior to bid. In the absence of such written notice and by the act of submitting his bid, it shall be understood that the Contractor has included the cost of all required items in his bid, and that he will be responsible for the approved satisfactory functioning of the entire system without extra compensations.
- C. It is not the intent of this Section of the Specifications to make any Contractor, other than the General Contractor, Prime Contractor, Construction Manager responsible to the Owner. All transactions such as submittal of shop drawings, claims for extra costs, requests for equipment or materials substitution, shall be routed through the General Contractor to the Architect, then to the Engineer. Also, this Section of the Specifications shall not be construed as an attempt to arbitrarily assign responsibility of work, material, equipment or services to a particular trade or Contractor. Unless stated otherwise, the subdivision and assignment of work under the various sections shall be optional.
- D. This section of the Specifications or the arrangement of the Contract Documents shall not be construed as an attempt to arbitrarily assign responsibility for work, material, equipment or services to a particular trade Contractor or Sub-Contractor. Unless stated otherwise, the subdivision and assignment of work under the various sections shall be the responsibility of the Contractor holding the Prime Contract.
- E. It is the intent of this Contract to deliver to the Owners a "like new" project once work is complete. Although plans and specifications are complete to the extent possible, it shall be responsibility of the Contractors involved to remove and/or relocate or re-attach any existing or new systems which interfere with new equipment or materials to be installed by other trades without additional cost to the Owner.
- F. In general, and to the extent possible, all work shall be accomplished without interruption of the existing facilities' operations. Each Contractor shall advise the Architect, Owner and Engineer in writing at least one week prior to the deliberate interruption of any services. The Owners shall be advised of the exact time that interruption will occur and the length of time the interruption will occur. Failure to comply with

this requirement may result in complete work stoppage by the Contractors involved until a complete schedule of interruptions can be developed. Contractor will not be entitled to additional compensation due to work stoppage mandated by unscheduled interruption.

- G. Whenever utilities are interrupted, either deliberately or accidentally, the Contractor shall work continuously to restore said service. The Contractor shall provide tools, materials, skilled journeymen of his own and other trades as necessary, premium time as needed and coordination with all applicable utilities, including payment of utility company charges (if any), all without requests for extra compensation to the Owner, except where otherwise provided for in the contract for the work. The Contractor shall abide by the requirements of the Special Conditions and the Owner's outage request program.
- H. Required Notices: Ten days prior to the submission of a proposal, each proposer shall give written notice to the Engineer of any materials or apparatus believed inadequate or unsuitable; in violation of laws, ordinances, rules or regulations of authorities having jurisdiction; and any necessary items of work omitted. In the absence of such written notice, Proposers signify that they have included the cost of all required items in the proposal and that the Proposer will be responsible for the safe and satisfactory operation of the entire system.
- I. Any reference within these specifications to a specific entity, i.e., "Electrical Contractor" is not to be construed as an attempt to limit or define the scope of work for that entity or assign work to a specific trade or contracting entity. Such assignments of responsibility are the responsibility of the Contractor or Construction Manager holding the prime contract, unless otherwise provided herein.
- J. In each of the specifications and drawings referred to herein, consider the advisory provisions to be mandatory, as though the word, "shall" had been substituted for "should" wherever it appears. Equipment, materials, installation, and workmanship shall be in accordance with the mandatory and advisory provisions of NFPA 70 unless more stringent requirements are specified or indicated.

1.3 DEFINITIONS AND ABBREVIATIONS

- A. Prime Contractor - The Contractor who has been engaged by the Owner in a contractual relationship to accomplish the work.
- B. Contractor - Any Contractor whether bidding, proposing or working independently or under the supervision of a General Contractor, Prime Contractor, Construction Manager and who installs any type of Electrical Work as specified in the Contract Documents.
- C. Electrical Contractor - Any Contractor whether bidding or working independently or under the supervision of a General Contractor, that is: the one holding the Prime Contract and who installs any type of Electrical work, such as: power, lighting, television, telecommunications, data, fiber optic, intercom, fire detection and alarm, security, video, underground or overhead electrical, etc.
- D. Electrical Sub-Contractor - Each or any Contractor contracted to, or employed by, the Electrical Contractor for any work required by the Electrical Contractor.
- E. Engineer - The Consulting Mechanical-Electrical Engineer either consulting to the Owner, Architect, or Other, etc. In this case: CMTA, Inc., Consulting Engineers.
- F. Architect - The Architect of Record for the project.
- G. Contract Documents - All documents pertinent to the quality and quantity of work to be performed on this project. Includes, but not limited to: Plans, Specifications, Instructions to Bidders, General and Special Conditions, Addenda, Alternates, Lists of Materials, Lists of Sub-Contractors, Unit Prices, Shop Drawings, Field Orders, Change Orders, Cost Breakdowns, Schedules of Value, Periodical Payment Requests, Construction Manager's Assignments, Architect's Supplemental Instructions, Construction Contract with Owner, etc.

- H. Bidder/Proposer - Any person, agency or entity submitting a proposal to any person, agency or entity for any part of the work required under this contract.
- I. The Project - All of the work required under this Contract.
- J. Furnish - Deliver to the site in good condition and turn over to the Contractor who is to install.
- K. Provide - Furnish and install complete, tested and ready for operation.
- L. Install - Install equipment furnished by others in complete working order.
- M. Indicated - Listed in the Specifications, shown on the Plans or Addenda thereto.
- N. Basis of Design (BOD): Documentation of primary thought processes and assumptions behind design decisions made to meet design intent. Describes systems, components, conditions and methods chosen to meet intent.
- O. Monitoring: Recording of parameters (flow, current, status, pressure, etc.) of equipment operation using data loggers or trending capabilities of control systems.
- P. Start-up: The activities where systems or equipment are initially tested and operated. Start-up is completed prior to functional testing.
- Q. Vendor: Supplier of equipment.
- R. Typical or Typ- Where indicated repeat this work, method or means each time the same or similar condition occurs whether indicated or not.
- S. Abbreviations:
 - 1. ADA - Americans with Disabilities Act.
 - 2. AFF – Above Finished Floor
 - 3. AFG – Above Finished Grade
 - 4. AIC – Amps Interrupting Capacity
 - 5. ANSI - American National Standards Institute.
 - 6. ASA – American Standards Association.
 - 7. ASTM – American Society for Testing Materials.
 - 8. ASHRAE - American Society of Heating, Refrigeration and Air Conditioning Engineers.
 - 9. BAS – Building Automation System.
 - 10. BICSI – Building Industry Consulting Services International
 - 11. CM – Construction Manager
 - 12. EC – Electrical Contractor
 - 13. EM - Emergency
 - 14. FCC – United States Federal Communications Commission
 - 15. FLA – Full Load Amps
 - 16. GC – General Contractor
 - 17. IECC – International Energy Conservation Code
 - 18. IEEE – Institute of Electrical and Electronics Engineers.
 - 19. IESNA – Illuminating Engineering Society of North America
 - 20. ISO – International Standards Organization.
 - 21. LRA – Locked Rotor Amps
 - 22. MC – Mechanical Contractor
 - 23. MCA – Minimum Circuit Ampacity
 - 24. MOCP – Maximum Overcurrent Protection
 - 25. NEC – National Electrical Code (NFPA 70).
 - 26. NECA – Standards for Installation.
 - 27. NEMA - National Electrical Manufacturers Association.
 - 28. NESC – National Electrical Safety Code.
 - 29. NFPA - National Fire Protection Association.
 - 30. NRTL: Nationally Recognized Testing Laboratory

- 31. N/A – Not Applicable
- 32. OSHA - Office of Safety and Health Administration.
- 33. PC – Plumbing Contractor
- 34. SPD: Surge Protection Device
- 35. TIA – Telecommunications Industry Association
- 36. RFI – Request for Information
- 37. RIO – Rough-in Only
- 38. UL - Underwriters Laboratories, Inc.
- 39. UON – Unless otherwise noted.

1.4 INTENT AND INTERPRETATION

- A. It is the intent of these specifications and all associated drawings that the Contractor provide finished work, tested, and ready for operation. Wherever the word "provide" is used, it shall mean "furnish and install complete, tested and ready for operation."
- B. Minor details not usually shown or specified, but necessary for the proper installation and operation, shall be included in the work, the same as if herein specified or shown.
- C. It is the intention of the Contract Documents to call for a complete and operational system, including all components, accessories, finish work, etc. as necessary for trouble free operation; tested and ready for operation. Anything that may be required, implied, or inferred by the Contract Documents shall be provided and included as part of the Bid.
- D. All Contractors and Vendors providing a bid for this project shall review the Plans and Specifications and determine any modifications and/or adjustments necessary relative to the proposed equipment and materials with specific manufacturer's installation requirements. Include in the bid any necessary installation methods, features, options, accessories, etc. necessary to install the proposed equipment and materials, regardless of whether used as basis of design or being offered as a substitution in accordance with the specific manufacturer's installation requirements whether specifically detailed or not within the Plans and Specifications.
- E. Details not usually shown or specified, but necessary for the proper installation and operation of systems, equipment, materials, etc., shall be included in the work, the same as if herein specified or indicated.
- F. The Bidder/Proposer shall completely review the Contract Documents. Any interpretation as to design intent or scope shall be provided by the Engineer / Architect. Should an interpretation be required, the Bidder/Proposer shall request a clarification not less than ten (10) days prior to the submission of the proposal so that the condition may be clarified by Addendum. In the event of any conflict, discrepancy, or inconsistency develops; the interpretation of the Engineer shall be final.
- G. The Contractor shall give written notice of any materials or apparatus believed inadequate or unsuitable; in violation of laws, ordinances, rules or regulations of authorities having jurisdiction; and any necessary items of work omitted a minimum of ten (10) days prior to bid. In the absence of such written notice and by the act of submitting a bid, it shall be understood that the Contractor has included the cost of all required items in the bid, and that will be responsible for the approved satisfactory functioning of the entire system without extra compensations.

1.5 ELECTRICAL DRAWINGS AND SPECIFICATIONS

- A. The drawings are diagrammatic only and indicate the general arrangement of the systems and are to be followed insofar as possible. If deviations from the layouts are necessitated by field conditions, detailed layouts of the proposed departures shall be submitted in writing to the Engineer for approval before proceeding with the work. The Contract Drawings are not intended to show every vertical or horizontal offset which may be necessary to complete the systems. Contractors shall, however, anticipate that additional offsets may be required and submit their bid accordingly.
- B. The drawings and specifications are intended to supplement each other. No Contractor, bidder, proposer or supplier shall take advantage of conflict between them, or between parts of either, but should this condition exist, the Contractor or supplier shall request a clarification of the condition at least ten days

prior to the submission of bids so that the condition may be clarified by Addendum. In the event that such a condition arises after work is started, the interpretation of the Engineer shall be the determining factor. In all instances, unless modified in writing and agreed upon by all parties thereto, the Contract to accomplish the work shall be binding on the affected Contractor.

- C. The drawings and specifications shall be considered to be cooperative and complimentary and anything appearing in the specifications which may not be indicated on the drawings or conversely, shall be considered as part of the Contract and must be executed the same as though indicated by both.
- D. This Contractor shall make all his own measurements in the field and shall be responsible for correct fitting. He shall coordinate this work with all other branches of work in such a manner as to cause a minimum of conflict or delay.
- E. The Engineer shall reserve the right to make minor adjustments in location of conduit, fixtures, outlets, switches, etc., where he considers such adjustments desirable in the interest of concealing work or presenting a better appearance.
- F. Each Contractor shall evaluate ceiling heights called for on Architectural Plans. Where the location of Electrical equipment may interfere with ceiling heights, the Contractor shall call this to the attention of the Engineer in writing prior to making the installation. Any such changes shall be anticipated and requested sufficiently in advance so as to not cause extra work on the part of the Contractor or unduly delay the work.
- G. Should overlap of work between the various trades become evident, this shall be called to the attention of the Engineer. In such an event, neither trade shall assume that he is to be relieved of the work which is specified under his branch until instructions in writing are received from the Engineer.
- H. The Electrical drawings are intended to show the approximate location of equipment, materials, etc. Dimensions given in figures on the drawings shall take precedence over scaled dimensions and all dimensions whether given in figures or scaled shall be verified in the field. In case of conflict between small and large scale drawings, the larger scale drawings shall take precedence.
- I. The Electrical Contractor and his Sub-Contractors shall review all drawings in detail as they may relate to his work (structural, architectural, site survey, mechanical, etc.). Review all drawings for general coordination of work, responsibilities, ceiling clearances, wall penetration points, chase access, fixture elevations, etc. Make any pertinent coordination or apparent conflict comments to the Engineers at least ten (10) days prior to bids, for issuance of clarification by written addendum.
- J. Where on any of the drawings a portion of the work is drawn out and the remainder is indicated in outline, or not indicated at all, the parts drawn out shall apply to all other like portions of the work. Where ornament or other detail is indicated by starting only, such detail shall be continued throughout the courses or parts in which it occurs and shall also apply to all other similar parts of the work, unless otherwise indicated.
- K. Special Note: Always check ceiling heights indicated on Drawings and Schedules and insure that these heights may be maintained after all mechanical and electrical equipment is installed. If a conflict is apparent, notify the Engineer in writing for instructions.

1.6 EXAMINATION OF SITE AND CONDITIONS

- A. Each Contractor shall inform himself of all of the conditions under which the work is to be performed, the site of the work, the structure of the ground, the obstacles that may be encountered, the availability and location of necessary facilities and all relevant matters concerning the work. All Contractors shall carefully examine all Drawings and Specifications and inform themselves of the kind and type of materials to be used throughout the project and which may, in any way, affect the execution of his work.
- B. Each Contractor shall fully acquaint himself with all existing conditions as to ingress and egress, distance of haul from supply points, routes for transportation of materials, facilities and services, availability of temporary or permanent utilities, etc. The Contractor shall include in his work all expenses or disbursements in connection with such matters and conditions. Each Contractor shall verify all work

shown on the drawings and conditions at the site, and shall report in writing to the Engineer ten (10) days prior to bid, any apparent omissions or discrepancies in order that clarifications may be issued by written addendum. No allowance is to be made for lack of knowledge concerning such conditions after bids are accepted.

- C. The Electrical Contractor is required to provide coordination drawings, data and collaboration for all aspects of his work in accordance with the general and special conditions – Divisions 20, 21, 22, 23, 25, 26, 27 and 28 and the Construction Manager’s procedures.

1.7 EQUIPMENT AND MATERIALS SUBSTITUTIONS OR DEVIATIONS

- A. When any Contractor requests review of substitute materials and/or equipment, and when under an approved formal alternate proposal, it shall be understood and agreed that such substitution, if approved, will be made without additional cost regardless of changes in connections, spacing, service, mounting, etc. In all cases where substitutions affect other trades, the Contractor offering such substitutions shall advise all such Contractors of the change and shall reimburse them for all necessary changes in their work. Any drawings, Specifications, Diagrams, etc., required to describe and coordinate such substitutions or deviations shall be professionally prepared at the responsible Contractor's expense. Special Note: Review of Shop Drawings by the Engineer does not absolve the Contractor of this responsibility.
- B. References in the specifications to any article, device, product, material, fixture, form, or type of construction by name, make, or catalog number shall be interpreted as establishing a standard of quality and shall not be construed as limiting competition. Each Contractor, in such cases, may, at his option, use any article, device, product, material, fixture, form, or type of construction which in the judgment of the Engineer is equivalent to that specified, provided the provisions of Paragraph 5.1 immediately preceding are met. Substitutions shall be submitted to the Engineer a minimum of ten (10) days prior to bid date for approval to bid in written form through addenda or other method selected by the Engineer. If prevailing laws of cities, towns, states or countries are more stringent than these specifications regarding such substitutions, then those laws shall prevail over these requirements.
- C. Wherever any equipment and material is specified exclusively only such items shall be used unless substitution is accepted in writing by the engineers.
- D. Each Contractor shall furnish along with his proposal a list of specified equipment and materials which he proposes to provide. Where several makes are mentioned in the Specifications and the Contractor fails to state which he proposes to furnish, the Engineer shall have the right to choose any of the makes mentioned without change in price.

1.8 SINGLE SOURCE RESPONSIBILITY AND OBSOLETE EQUIPMENT

- A. Except where specifically noted otherwise, all equipment supplied by the Contractor shall be the standard products of a single manufacturer of known reputation and experience in the industry. Only equipment, components and accessories in current production for at least five (5) years beyond the completion date of this system shall be used and installed. Any equipment found to be obsolete or not in future production will be removed and replaced at Contractor’s expense. This includes all equipment, materials and labor.

1.9 CODES, RULES, PERMITS, FEES, REGULATIONS, ETC.

- A. The Contractor shall give all necessary notices, obtain and pay for all permits, government sales taxes, fees, and other costs including utility connections or extensions, in connection with his work. As necessary, he shall file all required plans, utility easement requests and drawings, survey information on line locations, load calculations, etc., prepare all documents and obtain all necessary approvals of all utility and governmental departments having jurisdiction; obtain all required certificates of inspection for his work and deliver same to the Engineer before request for acceptance and final payment for the work.
- B. Ignorance of Codes, Rules, regulations, utility company requirements, laws, etc., shall not diminish or absolve Contractor's responsibilities to provide and complete all work in compliance with such.

- C. The Contractor shall include in the work, without extra cost, any labor, materials, services, apparatus or drawings required in order to comply with all applicable laws, ordinances rules and regulations, whether or not shown on drawings and/or specified.
 - D. All materials furnished and all work installed shall comply with the current edition of the National Electrical Codes, National Fire Codes of the National Fire Protection Association, the requirements of local utility companies, and with the requirements of all governmental agencies or departments having jurisdiction.
 - E. All material and equipment for the electrical systems shall bear the approval label, or shall be listed by the Underwriters' Laboratories, Incorporated. Listings by other testing agencies may be acceptable with written approval by the Engineer.
 - F. All electrical work is to be constructed and installed in accordance with plans and specifications which have been approved in their entirety and/or reflect any changes requested by the State Fire Marshal, as applicable or required. Electrical work shall not commence until such plans are in the hands of the Electrical Contractor.
 - G. The Contractor shall insure that his work is accomplished in accord with OSHA Standards and any other applicable government requirements.
 - H. Where conflict arises between any code and the plans and/or specifications, the code shall apply except in the instance where the plans and specifications exceed the requirements of the code. Any changes required as a result of these conflicts shall be brought to the attention of the Engineer at least ten working days prior to bid date, otherwise the Contractor shall make the required changes at his own expense. The provisions of the codes constitute minimum standards for wiring methods, materials, equipment and construction and compliance therewith will be required for all electrical work, except where the drawings and specifications require better materials, equipment, and construction than these minimum standards, in which case the drawings and specifications shall be the minimum standards.
- 1.10 SUPERVISION OF WORK
- A. Each Contractor and Sub-Contractors shall personally supervise the work or have a competent superintendent on the project site at all times during progress of the work, with full authority to act for him in matters related to the project.
- 1.11 COST BREAKDOWNS AND PAY APPLICATION
- A. Within thirty days after acceptance of the Contract, each Contractor is required to furnish to the Engineer one copy of a detailed cost breakdown on each respective area of work. These cost breakdowns shall be made on forms provided or approved by the Engineer or Architect. Payments will not be made until satisfactory cost breakdowns are submitted. Refer to Division 0 and 1 specification sections for additional requirements.
 - B. In addition to cost breakdowns by specification section, the following shall also be provided: Material and labor shall be listed separately. These items are in addition to items listed in front-end specifications. Pay special attention to required withholding percentages for startup, testing, documentation, acceptance, owner training, etc. The breakdown shall be minimally as follows:
 - 1. Permitting
 - 2. Mobilization
 - 3. Electrical Shop Drawings/Submittals
 - 4. Electrical Coordination Drawings
 - 5. Temporary Power
 - 6. Interior Lighting Materials & Labor
 - 7. Lighting Controls Materials & Labor
 - 8. Electrical Distribution (Switchgear) Materials & Labor
 - 9. Feeders Materials & Labor
 - 10. Branch Circuiting Materials & Labor
 - 11. Service Grounding Materials & Labor

12. Surge Suppression Materials & Labor
13. Electrical Devices Materials & Labor
14. Spare lamps and ballasts
15. Electrical Distribution Equipment Startup, Testing, & Verification (shall equal 2.5% of Equipment Value)
16. Lighting and Lighting Controls Startup, Testing, & Verification (shall equal 2.5% of Equipment Value)
17. Low Voltage Systems Startup, Testing, & Verification (shall equal 5% of Equipment Value)
18. Emergency Engine Generator Standby Systems Startup, Testing, & Verification (shall equal 2.5% of Equipment Value)
19. Owner Training & Acceptance
20. Punchlist
21. As-Built/Record Drawings & Acceptance
22. O&M Manuals & Acceptance
23. Warranty
24. Demobilization

1.12 GUARANTEES AND WARRANTIES

- A. Each Contractor shall unconditionally guarantee all equipment, apparatus, materials, and workmanship entering into this Contract to be the best of its respective kind and shall replace all parts at his own expense, which fail or are deemed defective within one year from final acceptance of the work by the Engineer. The effective date of completion of the work shall be the date each or any portion of the work is accepted by the Engineer and Owner's Statement of Substantial Completion.
- B. Items of equipment which have longer guarantees, as called for in these specifications or as otherwise offered by the manufacturer, such as generators, engines, batteries, transformers, etc., shall have warranties and guarantees completed in order, and shall be in effect at the time of final acceptance of the work by the Engineer. The Contractor shall present the Engineer with such warranties and guarantees at the time of final acceptance of the work. The Owner reserves the right to use equipment installed by the Contractor prior to date of final acceptance. Such use of equipment shall in no way invalidate the guarantee except that the Owner shall be liable for any damage to equipment during this period due to negligence of his operator or other employee.
- C. The Warranties specified in this and other Articles shall not deprive the Owner of other rights the Owner may have under provisions of the Contract Documents and shall be in addition to, and run concurrently with other warranties made by the Contractor under requirements of the Contract Documents.
- D. All light fixtures shall have a five (5) year unconditional warranty (Parts, Labor and Travel)
- E. Provide all warranty certificates to Owner. All warranties begin starting at the substantial completion date, submit warranty certificates accordingly.

1.13 INSPECTION, APPROVALS AND TESTS

- A. Before requesting a final review of the installation from the Architect and/or Engineer, the Contractor shall thoroughly inspect his installation to assure that the work is complete in every detail and that all requirements of the Contract Documents have been fulfilled. Failure to accomplish this may result in charges from the Architect and/or Engineers for unnecessary and undue work on their part.
- B. The Contractor shall advise each Inspection Agency in writing (with an information copy of the correspondence to the Architect and/or Engineer) when he anticipates commencing work. Failure of the Inspection Agency to inspect the work in the stage following and submit the related reports may result in the Contractor's having to expose concealed work not so inspected. Such exposure will be at the expense of the responsible Contractor.
- C. Inspections shall be scheduled for rough as well as finished work. The rough inspections shall be divided into as many inspections as may be necessary to cover all roughing-in without fail. Report of each such

inspection visit shall be submitted to the Architect, Engineer and the Contractor within three days of the inspection.

1.14 CHANGES IN ELECTRICAL WORK

- A. REFER TO GENERAL AND SPECIAL CONDITIONS.

1.15 CLAIMS FOR EXTRA COST

- A. REFER TO GENERAL AND SPECIAL CONDITIONS.

1.16 SURVEYS, MEASUREMENTS AND GRADES

- A. The Contractor shall lay out his work and be responsible for all necessary lines, levels, elevations and measurements. He must verify the figures shown on the drawings before laying out the work and will be held responsible for any error resulting from his failure to do so.
- B. The Contractor shall base all measurements, both horizontal and vertical from established bench marks. All work shall agree with these established lines and levels. Verify all measurements at site and check the correctness of same as related to the work.
- C. Should the Contractor discover any discrepancy between actual measurements and those indicated, which prevents following good practice or the intent of the drawings and specifications, he shall notify the Engineer thru normal channels of job communication and shall not proceed with his work until he has received instructions from the Engineer.

1.17 UTILITY COMPANY REQUIREMENTS

- A. The Contractor shall provide the local utility company with a drawing produced by a licensed Land Surveyor or a licensed Engineer in the State of Ohio and acceptable to the utility that locates the centerline of the primary duct. Coordinate further requirements with utility company.
- B. Contact the utility company for specifics on construction of pads, conduit, etc., prior to bidding the work and determine all their requirements. All work shall be in accordance with their standards.
- C. The Electrical Contractor is responsible for all fees, permit costs, etc., from the electrical utility, data, telephone and cable TV companies. This includes any cost associated with the underground electrical service extension.
- D. The owner is responsible for all fees, permit costs, etc., from the electrical utility, data, telephone and cable TV companies. This includes any cost associated with the underground electrical service extension.
- E. Each contractor, prior to bidding the work, is to contact the utility companies (electric) and determine the exact points of extension of all underground services in the field with a representative of each utility company. Also, obtain construction details on manholes, transformer pads, pedestal stub-ups, etc., from each utility company as applicable. Extension points indicated on the plans are approximate, and are given for the bidder's information only.

1.18 TEMPORARY SERVICES

- A. The Contractor shall arrange for temporary electrical and other services which he may require to accomplish his work. In the absence of other provisions in the contract, the Contractor shall provide for his own temporary services of all types, including the cost of connections, utility company fees, construction, removal, etc., in his bid.
- B. All temporary services shall be removed by Contractor prior to acceptance of work.

1.19 TEMPORARY USE OF EQUIPMENT

- A. The permanent electrical equipment, (except lighting), when installed, may be used for temporary services, subject to an agreement among the Contractors involved, the Owner, and with the consent of the Engineer. Should the permanent systems be used for this purpose, each Contractor shall pay for all temporary connections required and any replacements required due to damage without cost, leaving the

equipment and installation in "as new" condition. The Contractor may be required to bear utility costs, user fees, etc.

- B. Permission to use the permanent equipment does not relieve the Contractors who utilize this equipment from the responsibility for any damages to the building construction and/or equipment which might result because of its use.

1.20 MATERIALS AND WORKMANSHIP

- A. All electrical equipment, materials and articles incorporated in the work shall be new and of comparable quality to that specified. All workmanship shall be first-class and shall be performed by electricians skilled and regularly employed in their respective trades. The Contractor shall determine that the equipment he proposes to furnish can be brought into the building(s) and installed within the space available. All equipment shall be installed so that all parts are readily accessible for inspection, maintenance, replacement, etc. Extra compensation will not be allowed for relocation of equipment for accessibility or for dismantling equipment to obtain entrance into the building(s).
- B. All conduit and/or conductors shall be concealed in or below walls, below floors or above ceilings, unless otherwise noted. All fixtures, devices and wiring required shall be installed to make up complete systems as indicated on the drawings and specified herein. Raceways shall not be placed within foundation walls and footings.
- C. All materials, where applicable, shall bear Underwriters' Laboratories label or that of another Engineer approved testing agency, where such a standard has been established.
- D. Each length of conduit, wireway, duct, conductor, cable, fitting, fixture and device used in the electrical systems shall be stamped or indelibly marked with the maker's mark or name.
- E. All electrical equipment shall bear the manufacturer's name and address and shall indicate its electrical capacity and characteristics.
- F. All electrical materials, equipment and appliances shall conform to the latest standards of the National Electric Manufacturers Association (NEMA) and the National Board of Fire Underwriters (NBFU) and shall be approved by the Owner's insuring agency if so required.
- G. Comply with National Electrical Contractors Association (NECA) performance standards that are published as National Electrical Installation Standards (NEIS).
- H. All applicable equipment and devices provided shall meet all FCC requirements and restrictions.

1.21 QUALIFICATIONS OF WORKMEN

- A. All Electrical Contractors bidding this project must have been a licensed company for a minimum of three (3) years to qualify to bid this project. Individual employee experience does not supersede this requirement.
- B. All subcontractors bidding the electrical work must have completed one project of 70% this subcontract cost size and two projects of 50% this subcontract cost size.
- C. All electrical work shall be accomplished by qualified workmen competent in the area of work for which they are responsible. Untrained and incompetent workmen as evidenced by their workmanship shall be relieved of their responsibilities in those areas. The Engineer shall reserve the right to determine the quality of workmanship of any workman and unqualified or incompetent workmen shall refrain from work in areas not satisfactory to him. Requests for relief of a workman shall be made through the normal channels of responsibility established by the Architect or the contract document provisions.
- D. All electrical work shall be accomplished by Journeymen electricians under the direct supervision of a licensed Electrician. All applicable codes, utility company regulations, laws and permitting authority of the locality shall be fully complied with by the Contractor.
- E. Special electrical systems, such as Fire Detection and Alarm Systems, Telecommunications or Data Systems, Video Systems, Special Electronic Systems, Control Systems, etc., shall be installed by

workmen normally engaged or employed in these respective trades. As an exception to this, where small amounts of such work are required and are, in the opinion of the Engineer, within the competency of workmen directly employed by the Contractor involved, they may be provided by this Contractor.

1.22 CONDUCT OF WORKMEN

- A. The Contractor shall be responsible for the conduct of all workmen under his supervision. Misconduct on the part of any workmen to the extent of creating a safety hazard, or endangering the lives and property of others, shall result in the prompt relief of that workman. The consumption or influence of alcoholic beverages, narcotics or illegally used controlled substances on the jobsite is strictly forbidden.

1.23 COOPERATION AND COORDINATION BETWEEN TRADES

- A. The Contractor is expressly directed to read the General Conditions and all detailed sections of these specifications for all other trades and to study all drawings applicable to his work, including Architectural, Mechanical, Structural and other pertinent Drawings, to the end that complete coordination between trades will be effected.
- B. Refer to Coordination Among Trades, Systems Interfacing and Connection of Equipment Furnished by Others section of these Specifications for further coordination requirements. The Contractor is responsible for the correct location of all rough-in and connections at every piece of equipment. Work not correctly located shall be relocated at the Contractor's expense.
- C. Where any work is to be installed in close proximity to, or will interfere with work of other trades, each shall cooperate in working out space conditions to make a satisfactory adjustment. If so directed by the Engineer, the Contractor shall prepare composite working drawings and sections at a suitable scale not less than $\frac{1}{4}'' = 1'-0''$, clearly indicating how his work is to be installed in relation to the work of other trades, or so as not to cause any interference with work of other trades. He shall make the necessary changes in his work to correct the condition without extra charge.
- D. The Contractor shall furnish to other trades, as required, all necessary templates, patterns, setting plans, and shop details for the proper installation of work and for the purpose of coordinating adjacent work.

1.24 PROTECTION OF EQUIPMENT

- A. The Contractor shall be entirely responsible for all material and equipment furnished by him in connection with his work and special care shall be taken to properly protect all parts thereof from damage during the construction period. Such protection shall be by a means acceptable to the Engineer. All rough-in conduit shall be properly plugged or capped during construction in a manner approved by the Engineer. Equipment damaged while stored on site either before or after installation shall be repaired or replaced (as determined by the Engineer) by the responsible Contractor. Electrical equipment exposed to the weather shall be replaced by the Contractor at his expense.

1.25 SCAFFOLDING, RIGGING AND HOISTING

- A. The Contractor shall furnish all scaffolding, rigging, hoisting, and services necessary for erection and delivery into the premises of any equipment and apparatus furnished. All such temporary appurtenances shall be set up in strict accord with OSHA Standards and Requirements. Remove same from premises when no longer required.

1.26 CONCRETE WORK

- A. The Contractor shall be responsible for the provision of all concrete work required for the installation of any of his systems or equipment. If this work is provided by another trade, it will not relieve the Electrical Contractor of his responsibilities relative to dimensions, quality of workmanship, locations, etc. In the absence of other concrete specifications, all concrete related to Electrical work shall be 3000 PSI minimum compression strength at 28 days curing and shall conform to the standards of the American Concrete Institute Publication ACI-318. Heavy equipment shall not be set on pads for at least seven days after pour.

- B. All concrete pads shall be complete with all pipe sleeves, embeds, anchor bolts, reinforcing steel, concrete, etc., as required. Pads larger than 18" in width shall be reinforced with minimum #4 round bars on 6" centers both ways. All reinforcing steel shall be per ASTM requirements, tied properly, lapped 18 bar diameters and supported appropriately up off form, slab or underlayment. Bars shall be approximately 3" above the bottom of the pad with a minimum 2" cover. All parts of pads and foundations shall be properly rodded or vibrated. If exposed parts of the pads and foundations are rough or show honeycomb after removing forms properly adhered repairs shall be made. If structural integrity is violated, the concrete shall be replaced. All surfaces shall be rubbed to a smooth finish.
- C. Special Note: All pads and concrete lighting standard bases shall be crowned slightly so as to avoid water ponding beneath equipment.
- D. In general, concrete pads for small equipment shall extend 6" beyond the equipment's base dimensions. For large equipment with service access panels, extend pads 18" beyond base or overall dimensions to allow walking and servicing space at locations requiring service access.
- E. Exterior concrete pads shall be 4" minimum above grade and 4" below grade on a tamped 4" dense grade rock base unless otherwise noted or required by utility company. Surfaces of all foundations and bases shall have a smooth finish with three-quarter inch radius or chamfer on exposed edges, troweled or rubbed smooth. All exterior pads shall be crowned approximately 1/8" per foot, sloping from center for drainage.

1.27 SMOKE AND FIRE PROOFING

- A. The Contractor shall not penetrate rated fire walls, ceilings or floors with conduit, cable, bus duct, wireway or other raceway system unless all penetrations are protected in a code compliant manner which maintains the rating of the assembly. Smoke and fire stop all openings made in walls, chases, ceiling and floors. Patch all openings around conduit, wireway, bus duct, etc., with appropriate type material to smoke stop walls and provide needed fire rating at fire walls, ceilings and floors. Smoke and fire proofing materials and method of application shall be approved by the local authority having jurisdiction. Refer to architectural plans and specifications for further requirements.
- B. Contractor to provide heat detectors in the area of construction with complete fire detection until fire alarm system is operational and construction is complete.
- C. Fire-stopping materials and installation shall be by a single source through-out the project, by all trades.
- D. All fire-stopping assemblies must be UL listed. Provide shop drawings indicating penetration detail for each type of wall and floor construction. Shop drawings must be specific for each individual type (i.e., one-hour fire rated gypsum wall board with insulated metal pipe penetration.) and must indicate a UL listing for the complete fire-stopping assembly.
- E. 3M fire protection products are listed below. Equivalent products may be submitted if they are UL listed.
- F. All of the fire-stopping shall be applied by a Contractor who is certified by the manufacturer of the fire-stopping product for installation of the product.
- G. Fire-stopping materials to include but not limited to the following:
 - 1. 3M fire barrier FS-195 wrap/strip.
 - 2. 3M fire barrier CP 25 caulk.
 - 3. 3M fire barrier MP moldable putty.
 - 4. 3M fire barrier RC-1 restricting collar with steel hose clamp.
 - 5. 3M fire barrier damming materials.
 - 6. 3M fire barrier CS-195 composite sheet.
 - 7. 3M fire barrier fire dam 150 caulk.
 - 8. Steel sleeves.
 - 9. Hilti Speed Sleeves.

1.28 QUIET OPERATION, SUPPORTS, VIBRATION AND OSCILLATION

- A. All work shall operate under all conditions of load without any objectionable sound or vibration, the performance of which shall be determined by the Engineer. Noise from moving machinery or vibration noticeable outside of room in which it is installed, or annoyingly noticeable noise or vibration inside such room, will be considered objectionable. Sound or vibration conditions considered objectionable by the Engineer shall be corrected in an approved manner by the Contractor (or Contractors responsible) at his expense.
- B. All equipment subject to vibration and/or oscillation shall be mounted on vibration supports suitable for the purpose of minimizing noise and vibration transmission, and shall be isolated from external connections such as piping, ducts, etc., by means of flexible connectors, vibration absorbers or other approved means. Surface mounted equipment such as panels, switches, etc., shall be affixed tightly to their mounting surface.
- C. The Contractor shall provide supports for all equipment furnished by him using an approved vibration isolating type as needed. Supports shall be liberally sized and adequate to carry the load of the equipment and the loads of attached equipment, piping, etc. All equipment shall be securely fastened to the structure either directly or indirectly through supporting members by means of bolts or equally effective means. No work shall depend on the supports or work of unrelated trades unless specifically authorized in writing by the Architect or Engineer.

1.29 WELDING

- A. The Contractor shall be responsible for quality of welding done by his organization and shall repair or replace any work not done in accordance with the Architect's or structural Engineer's specifications for such work. If required by the Engineer, the responsible Contractor shall cut at least three welds during the job for X-raying and testing. These welds are to be selected at random and shall be tested as a part of the responsible Contractor's work. Certification of these tests and X-rays shall be submitted, in triplicate, to the Engineer. In case a faulty weld is discovered, the Contractor shall be required to furnish additional tests and corrective measures until satisfactory results are obtained.

1.30 ACCESSIBILITY

- A. The Contractor shall be responsible for the sufficiency of the size of shafts and chases, the adequate clearance in partitions and above suspended ceilings for the proper installation of his work. He shall cooperate with the General Contractor (or Construction Manager) and all other Contractors whose work is in the same space, and shall advise each Contractor of his requirements. Such spaces and clearances shall be kept to the minimum size required to ensure adequate clearance and access.
- B. The Contractor shall locate all equipment which must be serviced, operated, or maintained in fully accessible positions. Equipment shall include but not be limited to junction boxes, pull boxes, contactors, panels, disconnects, controllers, switchgear, etc. Minor deviations from drawings may be made to allow for better accessibility, and any change shall be approved where the equipment is concealed.
- C. Each Contractor shall provide (or arrange for the provision by other trades) the access panels for each concealed junction box, pull box, fixtures or electrical device requiring access or service as shown on Engineer's plans or as required. Locations of these panels shall be identified in sufficient time to be installed in the normal course of work. All access panels shall be installed in accord with the Architect's standards for such work. In the absence of such specifications, at a minimum such work shall comply with the specifications below. All locations for access panels which are not specifically indicated on the drawings shall be submitted to and approved by the architect prior to ordering.
- D. Access Doors; in Ceilings or Walls:
 - 1. In mechanical, electrical and service spaces: 14-gauge aluminum brushed satin finish, 1" border.
 - 2. In finished areas: 14-gauge primed steel with 1" border to accept the architectural finishes specified for the space. Confirm these provisions with the Architect prior to obtaining materials or installing any such work.
 - 3. In fire or smoke rated partitions, access doors shall be provided that equal or exceed the required rating of the construction they are mounted in.

1.31 RESTORATION OF NEW OR EXISTING SHRUBS, PAVING, ETC.

- A. The Contractor shall replace to their original condition all paving, curbing surfaces, drainage ditches, structures, fences, shrubs, existing or new building surfaces and appurtenances, and any other items damaged or removed by his operations. Replacement and repairs shall be in accordance with good construction practice and shall match materials employed in the original construction of the item to be replaced. All repairs shall be to the satisfaction of the Engineer, and in accord with the Architect's standards for such work, as applicable. Patchwork on new construction will not be accepted.

1.32 MAINTENANCE OF EXISTING UTILITIES AND LINES

- A. The locations of all piping, conduits, cables, utilities and manholes existing, or otherwise, that come within the contract construction site, shall be subject to continuous uninterrupted maintenance with no exception unless the Owner of the utilities grants permission to interrupt same temporarily, if need be. Provide one week's written notice to Engineer, Architect and Owner prior to interrupting any utility service or line. Also see Paragraph 1.2 - SUMMARY, of this specification.
- B. Known utilities and lines as available to the Engineer are shown on the drawings. However, it is additionally required that, prior to any excavation being performed, each Contractor ascertain and mark all utilities or lines that would be endangered by the excavation. Contractor shall bear costs of repairing damaged utilities.
- C. If the above mentioned utilities or lines occur in the earth within the construction site, the Contractor shall first probe and make every effort to locate the lines prior to excavating in the respective area.
- D. Cutting into existing utilities and services shall be done in coordination with and as designated by the Owner of the utility. The Contractor shall work continuously to restore service(s) upon deliberate or accidental interruption, providing premium time and materials as needed without extra claim to the Owner.
- E. The Contractor shall repair to the satisfaction of the Engineer any surface or subsurface improvements damaged during the course of the work, unless such improvement is shown to be abandoned or removed.
- F. Machine excavation shall not be permitted within ten feet of existing gas or fuel lines. Hand excavate only in these areas, in accord with utility company, agency or other applicable laws, standards or regulations.
- G. Protect all new or existing lines from damage by traffic, etc. during construction.
- H. Protect existing trees, indicated to remain with fencing or other approved method. Hold all new subsurface lines outside the drip line of trees, offsetting as necessary to protect root structures. Refer to planting or landscaping plans, or in their absence, consult with the Architect.

1.33 MANUFACTURER'S NAMEPLATE

- A. Each item of equipment shall have a nameplate bearing the manufacturer's name, address, model number, and serial number securely affixed in a conspicuous place; the nameplate of the distributing agent will not be acceptable.

1.34 ELECTRICAL CONNECTIONS

- A. The Contractor shall furnish and install all power wiring complete from power source to motor or equipment junction box, including power wiring through starters. The Contractor shall install all starters not factory mounted on equipment. Unless otherwise noted, the supplier of equipment shall furnish starters with the equipment. Also, refer to Division 20, 21, 22, 23, 24, 25, 26, 27, and 28 of Specifications, shop drawings and equipment schedules for additional information and requirements.
- B. All control, interlock, sensor, thermocouple and other wiring required for equipment operation shall be provided by the Contractor. All such installations shall be fully compliant with all requirements of Division 26, 27 and 28 regardless of which trade actually installs such wiring. Motors and equipment shall be provided for current and voltage characteristics as indicated or required. All wiring shall be enclosed in raceways unless otherwise noted.

- C. Each Contractor or Sub-Contractor, prior to bidding the work, shall coordinate power, control, sensor, interlock and all other wiring requirements for equipment or motors with all other contractors or sub-contractors, to ensure all needed wiring is provided in the Contract. Failure to make such coordination shall not be justification for claims of extra cost or a time extension to the Contract.

1.35 FINAL CONNECTIONS TO EQUIPMENT

- A. The roughing-in and final connections to all electrically operated equipment furnished under this and all other sections of the contract documents or by others, shall be included in the Contract and shall consist of furnishing all labor and materials for connection. The Contractor shall carefully coordinate with equipment suppliers, manufacturer's representatives, the vendor or other trades to provide complete electrical and dimensional interface to all such equipment (kitchen, hoods, mechanical equipment, panels, refrigeration equipment, etc.).

1.36 ENERGIZED EQUIPMENT

- A. At no time shall the contractor work on energized electrical equipment. Contractor shall comply with NFPA 70E requirements at all times throughout construction.

1.37 MOTORS

- A. Each motor shall be provided by the equipment supplier, installer or manufacturer with conduit terminal box and NEC required disconnecting means as indicated or required. Three-phase motors shall be provided with external thermal overload protection in their starter units. Single-phase motors shall be provided with thermal overload protection, integral to their windings or external, in control unit. All motors shall be installed with NEMA-rated starters as specified and shall be connected per the National Electrical Code.
- B. The capacity of each motor shall be sufficient to operate associated driven devices under all conditions of operation and load and without overload, and at least of the horsepower indicated or specified. Each motor shall be selected for quiet operation, maximum efficiency and lowest starting KVA per horsepower as applicable. Motors producing excessive noise or vibration shall be replaced by the responsible contractor. Refer to Division 20, 21, 22, 23 and 25 of the Specifications for further requirements and scheduled sizes.
- C. All three-phase motors shall be tested for proper rotation. Correct wiring if needed and retest. Document testing and corrective action in operations and maintenance manual.

1.38 CUTTING AND PATCHING

- A. Unless otherwise indicated or specified, the Contractor shall provide cutting and patching necessary to install the work specified in this Division. Patching shall match adjacent surfaces to the satisfaction of the Engineer and shall be in accord with the Architect's standards for such work, as applicable.
- B. No structural members shall be cut without the approval of the Structural Engineer and all such cutting shall be done in a manner directed by him.
- C. When installing conduit, pipe, or any other work in insulated concrete form (ICF) walls, the responsible subcontractor for the work shall provide spray foam insulation to patch the rigid insulation to maintain full integrity of the insulating value of the wall after the mechanical and electrical work is complete. Furthermore, all new work shall NOT be installed in concrete center of wall. All mechanical and electrical installations shall be on the interior side of the concrete.

1.39 SLEEVES AND PLATES

- A. Each Contractor shall provide and locate all sleeves and inserts required for his work before the floors and walls are built, or shall be responsible for the cost of cutting and patching required where sleeves and inserts were not installed, or where incorrectly located. Each Contractor shall do all drilling required for the installation of his hangers. Drilling of anchor holes may be prohibited in post-tensioned concrete construction, in which case the Contractor shall request approved methods from the Architect and shall carefully coordinate setting of inserts, etc., with the Structural Engineer and/or Architect.

- B. Sleeves shall be provided for all electrical conduit passing thru concrete floor slabs and concrete, masonry, tile and gypsum wall construction. Sleeves shall not be provided for piping running embedded in concrete or insulating concrete slabs on grade, unless otherwise noted.
- C. Where sleeves are placed in exterior walls below grade, the space between the pipe or conduit and the sleeves shall be packed with oakum and lead, mechanical water stop or other approved material and made completely water tight by a method approved by the Engineer and/or Architect.
- D. Where conduit motion due to expansion and contraction will occur, make sleeves of sufficient diameter to permit free movement of pipe. Check floor and wall construction finishes to determine proper length of sleeves for various locations; make actual lengths to suit the following:
 - 1. Terminate sleeves flush with walls, partitions and ceiling.
 - 2. In areas where pipes are concealed, as in chases, terminate sleeves flush with floor.
 - 3. In all areas where pipes are exposed, extend sleeves 1/2 inch above finished floor, except in rooms having floor drains, where sleeves shall be extended 3/4 inches above floor.
- E. Sleeves shall be constructed of 24-gauge galvanized sheet steel with lock seam joints for all sleeves set in concrete floor slabs terminating flush with the floor. All other sleeves shall be constructed of galvanized steel pipe unless otherwise indicated on the drawings.
- F. Fasten sleeves securely in floors, walls, so that they will not become displaced when concrete is poured or when other construction occurs around them. Take precautions to prevent concrete, plaster or other materials being forced into the space between pipe and sleeve during construction. Fire and smoke stop all sleeves in a manner approved by the local authority having jurisdiction or per prevailing codes.

1.40 ANCHORS

- A. Each Contractor shall provide and locate all inserts required for his work before the floors and walls are built, or shall be responsible for the cost of cutting and patching required where inserts were not installed, or where incorrectly located. Each Contractor shall do all drilling required for the installation of his hangers. Drilling of anchor holes may be prohibited in post-tensioned concrete construction, in which case the Contractor shall request approved methods from the Architect and shall carefully coordinate setting of inserts, etc., with the Structural Engineer and/or Architect.

1.41 CONDUIT MOUNTING HEIGHTS

- A. All exposed or concealed conduit, raceways, etc., shall be held as high as possible unless otherwise noted and coordinated with all other trades. Exposed conduit shall, insofar as possible, run perpendicular or parallel to the building structure.

1.42 PAINTING

- A. Each fixture device, panel, junction box, etc., that is located in a finished area shall be provided with finish of color and type as selected or approved by the Architect or Engineer. If custom color is required, it shall be provided at no additional cost to the Owner. All other equipment, fixtures or devices located in finished or unfinished areas, that are not required to have or are provided with finish color or coating shall be provided in a prime painted condition, ready to receive finish paint or coating. All galvanized metal in finished areas shall be properly prepared with special processes to receive finish paint as directed and approved by the Architect.

1.43 WEATHERPROOFING

- A. Where any work pierces waterproofing, including waterproof concrete, the method of installation shall be as approved by the Architect and/or Engineer before work is done. The Contractor shall furnish all necessary sleeves, caulking and flashing required to make openings absolutely watertight.
- B. Wherever work penetrates roofing, it shall be done in a manner that will not diminish or void the roofing guarantee or warranty in any way. Coordinate all such work with the roofing installer.

1.44 EQUIPMENT/CONTROLS STARTUP & VERIFICATION

- A. A pre-start-up conference shall be held with the Engineer, Owner, Construction Manager, General Contractor, Mechanical Contractor, Electrical Contractor, Controls Contractor, Test and Balance Contractor, and any manufacturer's providing startup services. The purpose of this meeting will be to discuss the goals, procedures, etc. for start-up
- B. Equipment and controls startup and verification shall be required for this project. A specific line-item shall be included on the schedule of values by each Trade for "equipment and controls startup". This line-item value shall be approved by the Engineer. The Engineer, Owner and the Engineer's Field Inspectors shall closely monitor progress and quality of the equipment and controls startup and may withhold pay requests as deemed appropriate.
- C. The Contractor shall include in the bid to provide equipment and controls startup and verification for ALL Electrical systems specified for this project. Specific startup/verification specifications are included throughout the Electrical specifications. In general, as part of the verification process, equipment suppliers shall perform start-up by their factory authorized technicians (not third party contractors) and shall complete and submit start-up reports/checklists. Submit factory start-up reports to the Engineer. The contractor shall have appropriate trades on site to correct all deficiencies noted by the factory representative. For each deficiency noted, documentation of corrective action (including date and time) shall be submitted to the Engineer and Owner.
- D. Many pieces of equipment and systems are specified with "manufacturer" startup. In general, the manufacturer's recommended startup procedures and checklists will be acceptable for use in the project. Where "manufacturer" startup is not specified, then this Contractor shall perform startup services in strict accordance with manufacturer's instructions. All startup/verification process shall be thoroughly documented by the Contractor and shall include the time and date when performed.
- E. The Contractor shall be responsible for completion of their own System Verification Checklist (SVC) / Manufacturer's Checklists. Furnish to the Testing Agent and Engineer. Sample checklists shall be submitted to the Engineer, Owner, and Testing Agent for approval.

1.45 OPERATING INSTRUCTIONS

- A. Unless specified otherwise in Division 1, each Contractor shall furnish three (3) complete bound sets for approval to the Engineer of typewritten and/or blueprinted instructions for operating and maintaining all systems and equipment included in this contract. All instructions shall be submitted in draft, for approval, prior to final issue. Manufacturer's advertising literature or catalogs will not be acceptable for operating and maintenance instructions.
- B. Unless specified otherwise in Division 1, each Contractor, in the above mentioned instructions, shall include the maintenance schedule for the principal items of equipment furnished under this contract and a detailed, easy to read parts list and the name and address of the nearest source of supply.

1.46 CLEANING

- A. The Contractor shall, at all times, keep the area of his work presentable to the public and clean of rubbish caused by his operations; and at the completion of the work, shall remove all rubbish, all of his tools, equipment, temporary work and surplus materials, from and about the premises, and shall leave the work clean and ready for use. If the Contractor does not attend to such cleaning immediately upon request, the Engineer may cause cleaning to be done by others and charge the cost of same to the responsible Contractor. Each Contractor shall be responsible for all damage from fire which originates in, or is propagated by, accumulations of his rubbish or debris.
- B. After completion of all work and before final acceptance of the work, each Contractor shall thoroughly clean all equipment and materials and shall remove all foreign matter such as grease, dirt, plaster, labels, stickers, etc., from the exterior of materials, equipment and all associated fabrication. Pay particular attention to finished area surfaces such as lighting fixture lenses, lamps, reflectors, panels, etc.

1.47 INDEMNIFICATION

- A. The Contractor shall hold harmless and indemnify the Engineer, employees, officers, agents, City's and Design Team's Rep and consultants from all claims, loss, damage, actions, causes of actions, expense and/or liability resulting from, brought for, or on account of any personal injury or property damage received or sustained by any person, persons, (including third parties), or any property growing out of, occurring, or attributable to any work performed under or related to this contract, resulting in whole or in part from the negligence of the Contractor, any subcontractor, any employee, agent or representative.

1.48 HAZARDOUS MATERIALS

- A. The Contractor is hereby advised that it is possible that asbestos and/or other hazardous materials are or were present in this building(s). Any worker, occupant, visitor, inspector, etc., who encounters any material of whose content they are not certain shall promptly report the existence and location of that material to the Contractor and/or Owner. The Contractor shall, as a part of his work, insure that his workers are aware of this potential and what they are to do in the event of suspicion. He shall also keep uninformed persons from the premises during construction. Furthermore, the Contractor shall insure that no one comes near to or in contact with any such material or fumes therefrom until its content can be ascertained to be non-hazardous.
- B. Any worker, occupant, visitor, inspector, etc., who encounters any material of whose content they are not certain shall promptly report the existence and location of that material to the Contractor and/or Owner. The Contractor shall, as a part of their work, insure that their workers are aware of this potential and what they are to do in the event of suspicion. The Contractor shall also keep uninformed persons from the premises during construction. Furthermore, the Contractor shall insure that no one comes near to or in contact with any such material or fumes therefrom until its content can be ascertained to be non-hazardous.
- C. CMTA, Inc., Consulting Engineers, have no expertise in the determination of the presence of hazardous materials. Therefore, no attempt has been made by them to identify the existence or location of any such material. Furthermore, CMTA nor any affiliate thereof will neither offer nor make any recommendations relative to the removal, handling or disposal of such material.
- D. If the work interfaces, connects or relates in any way with or to existing components which contain or bear any hazardous material, asbestos being one, then, it shall be the Contractor's sole responsibility to contact the Owner and so advise him immediately.
- E. The Contractor by execution of the contract for any work and/or by the accomplishment of any work thereby agrees to bring no claim relative to hazardous materials for negligence, breach of contract, indemnity, or any other such item against CMTA, its principals, employees, agents or consultants. Also, the Contractor further agrees to defend, indemnify and hold CMTA, its principals, employees, agents and consultants, harmless from any such related claims which may be brought by any subcontractors, suppliers or any other third parties.

1.49 ABOVE-CEILING AND FINAL PUNCH LISTS

- A. The Contractor shall review each area and prepare a punch list for each of the subcontractors, as applicable, for at least two stages of the project.
 - 1. For review of in-wall work that will be concealed by drywall or other materials well before substantial completion.
 - 2. For review of the above-ceiling work that will be concealed by tile or other materials well before substantial completion.
 - 3. For review of all other work as the project nears substantial completion.
- B. When all work from the Contractor's punch list is complete at each of these stages and prior to completing ceiling installations (or at the final punch list stage), the Contractor shall request that the Engineer develop a punch list. This request is to be made in writing two weeks prior to the proposed date. After all corrections have been made from the Engineer's punch list, the Contractor shall review and initial off on each item. This signed-off punch list and all work prior to the ceilings being installed and at the final punch list review.

- C. After all corrections have been made from the Engineer's punch list, the Contractor shall review and initial off on each item. This signed-off punch list shall be submitted to the Engineer. The Engineer shall return to the site once to review each punch list and all work prior to the ceilings being installed and at the final punch list review.
- D. At the engineer's option, the contractor shall supply digital photographs via email or file-share of any installed work.
- E. If additional visits are required by the Engineer to review work not completed by this review, the Engineer shall be reimbursed directly by the Contractor by check or money order (due 10 days from date of each additional visit) at a rate of \$125.00 per hour for extra trips required to complete either of the above-ceiling or final punch lists.
- F. All panelboard fronts shall be omitted until final punch list inspection is made. Directories for each panelboard shall be completed and available for review by the Engineer at that time.

1.50 TRAINING AND RELATED SUBMITTALS

- A. Upon completion of all work and all tests, Contractor shall provide classroom and in the field training for each type and/or model of equipment installed. Training shall be led by qualified factory certified technician. Contractor shall submit a request to schedule training sessions a minimum of two weeks in advance. Submission shall include qualifications of instructor as well as a syllabus that the Owner will add/deduct to as they see fit. Each individual listed as an "Attendee" on the roster submitted by the Owner shall receive a copy of the maintenance manual to review during training. All training sessions shall be recorded and a DVD with proper labels identifying the date, equipment, and project shall be delivered prior to Completion of the project. If the audio from the recording is unclear, narration shall be added. The Contractor shall certify in writing to the Engineer that such demonstrations have taken place, noting the date, time and names of the Owner's representative that were present.
- B. The training phase shall be accompanied by complete as-built documentation and the technical systems operation manual.
- C. These training sessions shall be videotaped by the Installer and copies provided to the Owner within one (1) week of training
- D. Brochures: Furnish Owner a complete set of operating instructions and diagrams.
- E. Systems/Components which require owner training. The training shall be accomplished by a factory trained representative. Include (8) hours minimum for each system described here-in. Each equipment representative shall be represented wherever their equipment is used. All training shall be videotaped by the Installer. The following systems shall include owner training at a minimum:
 - 1. Electrical Distribution (Switchgear)
 - 2. Service Grounding
 - 3. Electrical Devices
 - 4. Fire Alarm Materials & Labor
- F. Instruction Program: Submit outline of instructional program for demonstration and training, including a schedule of proposed dates, times, length of instruction time, and instructors' names for each training module. Include learning objective and outline for each training module.
- G. At completion of training, submit two complete training manual(s) for Owner's use.
- H. Qualification Data: For facilitator, instructor and photographer.
- I. Attendance Record: For each training module, submit list of participants and length of instruction time.
- J. Evaluations: For each participant and for each training module, submit results and documentation of performance-based test.
- K. Demonstration and Training DVDs: Submit two copies within seven days of end of each training module.
- L. Identification: On each copy, provide an applied label with the following information:

1. Name of Project.
 2. Name and address of photographer.
 3. Name of Architect and Construction Manager.
 4. Name of Contractor.
 5. Date video was recorded.
 6. Description of vantage point, indicating location, direction (by compass point), and elevation or story of construction.
- M. Transcript: Prepared on 8-1/2-by-11-inch paper, punched and bound in heavy duty, 3-ring, vinyl-covered binders. Mark appropriate identification on front and spine of each binder. Include a cover sheet with same label information as the corresponding video. Include name of Project and date of video on each page.
- 1.51 EQUIPMENT/SYSTEMS TESTING, VERIFICATION & START-UP
- A. The Contractor (and Sub-Contractors) shall be responsible for commissioning, starting-up, testing, checking, examining, inspecting, etc. their own systems.
 - B. The Electrical Contractor shall designate an individual under his employment to lead the start-up, testing and verification process. This person should not be the project manager or job site superintendent, but a person dedicated to making this critical task successful and completed in a timely manner.
 - C. This individual shall also be responsible for the following items:
 1. All identification and labeling requirements per plans and specifications.
 2. Submission of switchgear coordination study, fault current study, and arc flash hazard analysis.
 - D. A pre-start-up conference shall be held with the Architect, Owner, Construction Manager, Electrical Contractor, and the Manufacturers providing startup services. The purpose of this meeting will be discuss the goals, procedures, etc. for start-up.
 - E. A specific line-item shall be included on the schedule of values for testing and verification of all systems indicated in this section. This line-item value shall be approved by the Engineer. The Engineer, Owner and the Engineer's Field Inspector(s) shall closely monitor progress and quality of the testing, verification, and startup and may withhold pay requests as deemed appropriate.
 - F. The Contractor shall test all wiring and connections for continuity and grounds before equipment and fixtures are connected, and when indicated or required, demonstrate by Megger Test the insulation resistance of any circuit or group of circuits. Where such tests indicate the possibility of faulty insulation, locate the point of such fault, pull out the defective conductor, replacing same with new and demonstrate by further test the elimination of such defect.
 - G. Systems Requiring Testing & Verification:
 1. Electrical Distribution Equipment
 2. Lighting and Lighting Controls
 3. Grounding Systems
 - H. The Contractor shall include in the bid to provide systems startup and verification for ALL electrical systems specified for this project. Specific startup, testing, and verification specifications are included throughout the Electrical specifications. In general, as part of the verification process, equipment suppliers shall perform start-up by their factory authorized technicians (not third party Contractors) and shall complete and submit start-up reports/checklists. Submit start-up reports to the Engineer. The Contractor shall have appropriate trades on site to correct all deficiencies noted by the factory representative. For each deficiency noted, documentation of corrective action (including date and time) shall be submitted to the Engineer and Owner. Where factory start-up is not specified for a particular piece of equipment or system, the Contractor shall be responsible to perform start-up.
 - I. The Contractor shall be responsible for completion of System Verification Checklist (SVC) / Manufacturer's Checklists. Furnish to the Testing Agent and Engineer. Sample checklists shall be submitted to the Engineer, Owner, and Testing Agent for approval.

- J. The completed reports shall be organized and bound together in a tabbed binder and submitted for review and approval.

1.52 SPECIAL WRENCHES, TOOLS AND KEYS

- A. Each Contractor shall provide, along with the equipment provided, any special wrenches or tools necessary to dismantle or service equipment or appliances installed by him. Wrenches shall include necessary keys, handles and operators for valves, switches, breakers, etc. and keys to electrical panels, emergency generators, alarm pull boxes and panels, etc. At least two (2) of any such special wrench, keys, etc. shall be turned over to the Architect prior to completion of the project. Obtain a receipt that this has been accomplished and forward a copy to the Engineer.

1.53 CLOSEOUT DOCUMENTS

- A. All items listed in this section shall be provided to the engineer upon substantial completion. Provide three bound copies with complete index and tabs to locate each item.

B. As-Built Record Drawings:

1. The Contractor shall insure that any deviations from the design are being recorded daily, as necessary, on record drawings being maintained by the Contractor. Dimensions from fixed, visible permanent lines or landmarks shown in vertical and horizontal ways shall be utilized. Compliance shall be a requirement for final payment. Pay particular attention to the location of underfloor or underground exterior in-contract or utility-owned or leased service lines, main switches and other appurtenances important to the maintenance and safety of the Electrical System. Deliver these record drawings to the Engineer as a system is completed, within ten days of the mark-up and/or while the accuracy of the mark-ups can be verified visually. Monthly payment may be withheld if the requirement is not complied with.
2. All underground utilities/piping installed as part of this project shall be surveyed by a land surveyor licensed in the State of Ohio. This shall include underground electrical primary, communications, vaults. The survey shall include actual duct bank depths to top of conduit every 100 feet in length. The survey shall also include benchmarks dimensions relative to above grade, fixed structures. The survey shall be furnished on a compact disc in AutoCad “.dwg” format and “.pdf” format. Provide a GPS coordinate of each geothermal well and indicate on the as-built drawing. The survey information shall be included in the closeout documentation.
3. Refer to additional record drawing requirements within the general conditions and other sections of these specifications.

C. Start-up and System Testing Certifications and Reports:

1. Provide reports from all required testing to indicate procedures followed and complete results of all tests. Provide reports on manufacturer’s standard forms for all equipment and system tests. Testing shall be per applicable NEC, NFPA, UL, NETA, and/or ANSI standards.

D. Operation and Maintenance Manuals

1. Upon substantial completion of the project, the Contractor shall deliver to the Engineers (in addition to the required Shop Drawings) three (3) complete bound hard copies and a digital copy of operation and maintenance instructions and parts lists for all equipment provided in this contract. Formatting and content shall follow the guidelines outlined in the latest version of ASHRAE Application Handbook, Guideline 4. As a minimum, the following shall be included:
2. All instructions shall be submitted in draft, for approval, prior to final issue. Manufacturer's advertising literature or catalogs will not be acceptable for operating and maintenance instructions.
3. Each Contractor, in the above mentioned instructions, shall include the maintenance schedule for the principal items of equipment furnished under this contract and a detailed, easy to read parts list and the name and address of the nearest source of supply.
4. The operation and maintenance document directory should provide easy access and be well organized and clearly identified.
5. The operation and maintenance manuals shall contain the following information:

- a. Emergency information should be immediately available during emergencies and should include emergency and staff and/or agency notification procedures.
 - b. Provide contacts (company name, address, phone number, email) where parts may be purchased for all equipment.
 - c. Provide detailed maintenance instructions, including recommended preventative maintenance schedules for all equipment requiring maintenance. For lighting and lighting controls, provide recommended re-lamping program, provide a schedule for inspecting and recalibrating lighting controls, and provide a recommended settings list for all components with adjustable settings.
 - d. General Information. Provide the following:
 - 1) Building function
 - 2) Building description
 - 3) Operating standards and logs
 - e. Technical Information. Provide the following:
 - 1) System description
 - 2) Operating routines and procedures
 - 3) Seasonal start-up and shutdown
 - 4) Special procedures
 - 5) Basic troubleshooting
 - f. The maintenance manual should contain the following information:
 - 1) Equipment data sheets. Provide the following:
 - a) Vendor and local representative's contact information
 - b) Operating and nameplate data
 - c) Warranty
 - d) Detailed operating instructions.
 - e) Tools required
 - f) Types of cleaners to use
 - 2) Maintenance program information. Provide the following:
 - a) Manufacturer's installation, operation, and maintenance instructions
 - b) Spare parts information
 - c) Preventive maintenance actions
 - d) Schedule of actions
 - e) Action description
 - f) History
 - g. Test reports document observed performance during start-up and commissioning.
 - h. Reference Division 1 specifications for additional requirements.
- E. Shop drawings will not be accepted as satisfying the requirement for Operation and Maintenance Manuals.
- F. Shop Drawings: Provide complete copies of all approved shop drawings. Where shop drawings were returned "Furnish as Corrected", the contractor shall make the corrections noted by the engineer and submit final corrected shop drawings with close-out documentation.
- G. Parts Lists: Provide an inventory of all spare parts, special tools, attic stock, etc. that have been provided to the owner.
- H. Warranties: Contractor's one-year warranty and all other specific warranties indicated in the construction documents.
- I. Training Verification: Provide certification that all specified training has been completed. List training session dates, times, and types.

- J. Inspection Certificates: Provide certificates of inspection from electrical inspector, fire marshal, and any other required special inspections.
- K. Panel Schedules: Provide hard copies and digital copies of Excel files for all panel-board schedules.
- L. Final Power System Study Reports.
- M. Power Riser Diagram: Provide a framed full-size copy of the overall power riser diagram (under glass) to the Owner. Also, provide three (3) vinyl-coated copies of same. Where an existing power riser diagram is present, the Contractor shall obtain the document from the Owner, and update in digital format with the scope of this project. Edits shall be in digital format and this work shall be closely coordinated with the Owner.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION (260501)

DIVISION 26 - ELECTRICAL

SECTION 260502 - SCOPE OF THE ELECTRICAL WORK

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

The Contractor is directed to examine each and every section of these specifications, all drawings relating to the Contract Documents, any and all Addenda, etc., for work described elsewhere that may relate to the provision of the work described herein. Materials and performance requirements are specified elsewhere herein that relate to these systems.

Each Electrical Contractor's attention is directed to Section 260501 - General Provisions, Electrical, and all other Contract Documents as they apply to his work.

1.2 SCOPE OF THE ELECTRICAL WORK

The Electrical work for this project includes all labor, materials, equipment, fixtures, excavation, backfill and related items required to completely install, test, verify place in service and deliver to the Owner complete electrical systems in accordance with the accompanying plans and all provisions of these specifications. This work shall primarily include, but is not limited to the following:

1. All raceways, conduits, cable management systems, J-hooks, conductors, outlet boxes, fittings, pull boxes, manholes, etc.
2. All low-voltage distribution equipment, switchboards, panelboards, disconnect switches, company switches, fuses, transformers, contactors, starters, service pedestals, etc.
3. Electrical Contractor shall install, mount and wire VFD's which shall be furnished by the Mechanical Contractor, unless otherwise noted.
4. All wiring devices and device plates.
5. Cable splicing, terminations, supports, etc.
6. All light fixtures, drivers and lamps.
7. Electrical connection to all electrically operated equipment furnished and/or installed by others, including powered casework, mechanical equipment, etc.
8. Grounding, per NEC and specified requirements.
9. Identification of electrical systems and equipment labeling.
10. All low-voltage systems as listed in System Responsibilities Matrix on Electrical Legend.
11. All necessary coordination with the Owner, electric utility company to ensure that work, connections, etc., that they are to provide is accomplished and that service to this facility is delivered complete prior to occupancy.
12. Paying all necessary fees and costs for inspections of all Division 26, 27 and 28 systems by a Licensed Electrical Inspector.
13. Paying all necessary fees and cost for permits, electrical inspections, work by utility companies (power, telephone, cable television company, etc.). The Contractor shall contact the utility companies prior to submitting a bid to determine exactly these charges will be.
14. Prior to submitting a bid, the Contractor shall contact all serving utility companies and municipal services to determine exactly what each utility company will provide and exactly what is required of the Contractor and the Contractor shall include all such requirements in his base bid. This shall include relocation fees and construction cost recovery due to Power Utility Company and Cable Company or their successors.
15. All general and special conditions required to accomplish the work.

END OF SECTION

DIVISION 26 - ELECTRICAL

SECTION 260503 - SHOP DRAWINGS, SUBMITTALS, LITERATURE, MANUALS, PARTS LISTS, AND SPECIAL TOOLS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General, Special and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.
- B. The Contractor is directed to examine each and every section of these specifications, all drawings relating to the Contract Documents, any and all Addenda, etc., for work described elsewhere that may relate to the provision of the work described herein. Materials and performance requirements are specified elsewhere herein that relate to these systems.
- C. Each Electrical Contractor's attention is directed to Section 260501 - General Provisions, Electrical, and all other Contract Documents as they apply to his work.

1.2 SUMMARY

- A. Each Contractor shall submit to the Architect and/or Engineer, within thirty days after the date of the Contract, one (1) set of shop drawings and/or manufacturer's descriptive literature on all equipment required for the fulfillment of his contract. Each shop drawing and/or manufacturer's descriptive literature shall have proper notation indicated on it and shall be clearly referenced so the specifications, schedules, light fixture numbers, panel names and numbers, etc., so that the Architect and/or Engineer may readily determine the particular item the Contractor proposes to furnish. All data and information scheduled, noted or specified by hand shall be noted in color red on the submittals. The Contractor shall make any corrections or changes required and shall resubmit for final review as requested. Review of such drawings, descriptive literature and/or schedules shall not relieve the Contractor from responsibility for deviation from drawings or specifications unless they have, in writing, directed the reviewer's attention to such deviations at the time of submission of drawings, literature and manuals; nor shall it relieve them from responsibility for errors or omissions of any nature in shop drawings, literature and manuals. The term "as specified" will not be accepted.
- B. If the Contractor fails to comply with the requirements set forth above, the Architect and/or Engineer shall have the option of selecting any or all items listed in the specifications or on the drawings, and the Contractor will be required to provide all materials in accordance with this list.
- C. Review of shop drawings by the Engineer applies only to conformance with the design concept of the project and general compliance with the information given in the contract documents. In all cases, the installing Contractor alone shall be responsible for furnishing the proper quantity of equipment and/or materials required, for seeing that all equipment fits the available space in a satisfactory manner and that piping, electrical and all other connections are suitably located.
- D. The Engineer's review of shop drawings, schedules or other required submittal data shall not relieve the Contractor from responsibility for the adaptability of the equipment or materials to the project, compliance with applicable codes, rules, regulations, information that pertains to fabrication and installation, dimensions and quantities, electrical characteristics, and coordination of the work with all other trades involved in this project.
- E. No cutting, fitting, rough-in, connections, etc., shall be accomplished until reviewed equipment shop drawings are in the hands of the Contractors concerned. It shall be each Contractor's responsibility to obtain reviewed shop drawings and to make all connections, etc. in the neatest and most workmanlike manner possible. Each Contractor shall coordinate with all the other Contractors having any connections, roughing-in, etc., to the equipment, to make certain proper fit, space coordination, voltage and phase relationships are accomplished.

- F. Shop Drawings: Include wiring diagrams and installation details of equipment indicating proposed location, layout and arrangement, control panels, accessories, piping, ductwork, and other items that must be shown to ensure a coordinated installation. Wiring diagrams shall identify circuit terminals and indicate the internal wiring for each item of equipment and the interconnection between each item of equipment. Drawings shall indicate adequate clearance for operation, maintenance, and replacement of operating equipment devices.
- G. Product Data: Submittal shall include performance and characteristic curves.

1.3 SUBMITTALS AND SHOP DRAWING

- A. In accord with the provisions specified hereinbefore, shop drawings, descriptive literature and schedules shall be submitted on each of the following indicated items as well as any equipment or systems deemed necessary by the Engineer:
 - 1. Power Equipment
 - a. Switchboard and refurbishing existing panelboards.
 - b. Circuit breakers and fusible switches, per each type.
 - c. Electrical service pedestals.
 - d. Meter bases and CT cabinets.
 - e. Power and lighting contactors.
 - f. Building service grounding electrode components.
 - g. Metering devices.
 - h. Complete grounding system.
 - 2. Raceways
 - a. Conduits and each type of conduit fittings.
 - b. Ladder trays and each type of ladder tray fitting.
 - c. Surface-mounted metal or plastic raceways, with each type of fitting.
 - d. Wireways and each type of wireway fitting.
 - e. J-hook assembly.
 - f. Composite pullboxes.
 - 3. Conductors
 - a. Conductors, splicing devices, and connectors, each by type.
 - b. Splice or tap blocks.
 - 4. Devices
 - a. Each type of wiring device and their coverplates.
 - b. Floor boxes, each by type, with required accessories.
 - c. Data wallplates, each by type.
 - d. Any special items not listed above.
 - 5. Lighting
 - a. Light fixtures, each by type, marked to indicate all required accessories and lamp selection. Also provide original color selection chart to allow Architect and/or Engineer to indicate color selection.
 - b. Lamps, each by type.
 - c. Drivers, each by type.
 - d. Time clocks or other lighting accessories.
 - e. Lighting control system schematic, functional & programming data, along with building specific floor plan drawings indicating each device, master controller, input device locations and specific interconnect/wiring requirements for each device.
 - 6. Grounding

- a. Electrodes, bonding devices, terminals, etc.
- b. Building service grounding electrode components.
7. Dimensioned electrical room plans/equipment layouts
8. Fire-stopping materials including wrap, caulk, putty, sleeves, etc.
9. Miscellaneous
 - a. Non-standard junction/pullboxes.
 - b. Floor plan and riser drawings that show the location of all fire alarm devices.
 - c. Floor plan and riser drawings that show the location of all low-voltage systems.
10. Special wrenches, tools and keys

PART 2 - PRODUCTS – Not Used

PART 3 - EXECUTION – Not Used

END OF SECTION

DIVISION 26 – ELECTRICAL

SECTION 260504 - SLEEVING, CUTTING, PATCHING AND REPAIRING FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General, Special and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.
- B. The Contractor is directed to examine each and every section of these specifications, all drawings relating to the Contract Documents, any and all Addenda, etc., for work described elsewhere that may relate to the provision of the work described herein. Materials and performance requirements are specified elsewhere herein that relate to these systems.
- C. Each Electrical Contractor's attention is directed to Section 260501 - General Provisions, Electrical, and all other Contract Documents as they apply to his work.

1.2 ACTION SUBMITTALS

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

1.3 SUMMARY

- A. The Contractor shall be responsible for all openings, sleeves, trenches, etc. that he may require in floors, roofs, ceilings, walls, etc. and shall coordinate all such work with the Construction Manager, General Contractor and all other trades. He shall determine and coordinate any openings which he is to provide before submitting a bid proposal in order to avoid conflict and disagreement during construction. Improperly located openings shall be reworked at the expense of the responsible Contractor.
- B. The Contractor shall plan his work ahead and shall place sleeves, frames or forms through all walls, floors and ceilings during the initial construction, where it is necessary for conduit, conductors, wireways, etc. to go through; however, when this is not done, this Contractor shall do all cutting and patching required for the installation of his work, or he shall pay other trades for doing this work when so directed by the Architect. Any damage caused to the buildings by the workmen of the responsible Contractor must be corrected or rectified by him at his own expense.
- C. The Contractor shall cut holes in casework, equipment panels, etc. (if any), as required to pass pipes in and out.
- D. The Contractor shall notify other trades in due time where he will require openings of chases in new concrete or masonry. He shall set all concrete inserts and sleeves for his work. Failing to do this, he shall cut openings for his work and patch same as required at his own expense.
- E. Openings in slabs and walls shall be cut with core drill. Hammer devices will not be permitted. Edges of trenches and large openings shall be scribe cut with a masonry saw.
- F. Where any cutting, coring, etc. of reinforced concrete is required, such structures shall be x-rayed to avoid damaging existing reinforcing steel.
- G. Where sleeves are placed in exterior walls below grade, the space between the pipe or conduit and the sleeves shall be made completely water tight. Provide Crouse-Hinds Link-Seal Environmental Conduit Seal with stainless steel hardware. Alternative methods shall be approved by the Engineer and/or Architect during shop drawing review.
- H. In all cases, sleeves shall be at least two pipe sizes larger than nominal pipe diameter.
- I. All roof penetrations shall be made inside mechanical equipment curbs, UON.

- J. Sleeves passing through roof or exterior wall or where there is a possibility of water leakage and damage shall be caulked water tight for horizontal sleeves and flashed and counter-flashed with lead (4 lb.) or copper and soldered to the piping, lapped over sleeve and properly weather sealed.
- K. All rectangular or special shaped openings in plaster, stucco or similar materials including gypsum board shall be framed by means of plaster frames, casing beads, wood or metal angle members as required. The intent of this requirements is to provide smooth even termination of wall, floor and ceiling finishes as well as to provide a fastening means for lighting fixtures, panels, etc. Lintels shall be provided where indicated over all openings in bearing walls, etc.
- L. No cutting is to be done at points or in a manner that will weaken the structure and unnecessary cutting must be avoided. If in doubt, contact the Architect and Structural Engineer.
- M. The Contractor shall be responsible for properly shoring, bracing, supporting, etc. any existing and/or new construction to guard against cracking, settling, collapsing, displacing or weakening while openings are being made. Any damage occurring to the existing and/or new structures, due to failure to exercise proper precautions or due to action of the elements, shall be promptly and properly made good to the satisfaction of the Architect.
- N. All work improperly done or not done at all as required by the Electrical trades in this section will be performed by the Contractor at the direction of the trade whose work is affected. The cost of this work shall be paid for by the Contractor who is in non-compliance with the Contract.
- O. All penetrations shall be patched with materials matching that which has been disturbed.

PART 2 - PRODUCTS

2.1 SLEEVES

- A. Sleeves for Raceways:
 - 1. Steel Pipe Sleeves: ASTM A 53/A 53M, Type E, Grade B, Schedule 40, hot-dipped galvanized, plain ends.
 - a. Sleeves for exterior walls: Anchor flange welded to perimeter.
- B. Sleeves for Raceways Penetrating Non-Fire-Rated Gypsum Board Assemblies: Galvanized-steel sheet; 0.0239-inch minimum thickness; round tube closed with welded longitudinal joint, with tabs for screw-fastening the sleeve to the board.
- C. Sleeves for Rectangular Openings:
 - 1. Material: Galvanized sheet steel of length to suit application.
 - 2. Minimum Metal Thickness: Shall be 0.138 inch (10 gauge).
- D. Coordinate sleeve selection and application with selection and application of firestopping.

2.2 SLEEVE SEALS

- A. Description: Modular sealing device, designed for field assembly, to fill annular space between sleeve and conduit.
 - 1. Sealing elements: EPDM or NBR interlocking links shaped to fit surface of cable or conduit. Include type and number required for material and size of raceway or cable.
 - 2. Pressure plates: Stainless steel. Include two for each sealing element.
 - 3. Connecting bolts and nuts: Stainless-steel of length required to secure plates to sealing elements. Include one for each sealing element.

2.3 GROUT

- A. Description: Non-shrink; recommended for interior and exterior sealing openings in non-fire-rated walls or floors.

- B. Standard: ASTM C 1107/C 1107M, Grade B, post-hardening and volume-adjusting, dry, hydraulic-cement grout.
- C. Design Mix: 5000-psi, 28-day compressive strength.
- D. Packaging: Premixed and factory packaged.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Comply with NECA 1.
- B. Comply with NEMA VE 2 for cable tray and cable penetrations.
- C. The Contractor shall provide and locate all sleeves and inserts required for his work before the floors and surface being penetrated are built, otherwise the Contractor shall core drill for conduits where sleeves and inserts were not installed, or where incorrectly located. Core drilling is the only acceptable alternative to sleeves. Do not chisel openings. Where sleeves are placed in exterior walls or in slabs on grade, the space between the conduit and the sleeves shall be made completely and permanently water tight.
- D. Conduits that penetrate fire and/or smoke rated assemblies shall have sleeves installed as required by the manufacturer of the rating seal used.
- E. Fasten sleeves securely in floors, walls, so that they will not become displaced when concrete is poured or when other construction is built around them. Take precautions to prevent concrete, plaster or other materials being forced into the space between pipe and sleeve during construction.
- F. Sleeves in floors shall extend 4" above finished floor level.
- G. Escutcheon plates shall be provided for all conduits passing thru walls, floors and ceilings. Plates shall be nickel plated, of the split ring type, of size to match the conduit. Where plates are provided for conduits passing thru sleeves which extend above the floor surface, provide deep recessed plates to conceal the conduit sleeves.
- H. In all areas where busducts are exposed and pass thru floors, the opening shall be surrounded by a 4-inch-high by 3-inch-wide concrete curb.
- I. Roof-Penetration Sleeves: Seal penetration of individual raceways and cables with flexible boot-type flashing units applied in coordination with roofing work.

3.2 CUTTING

- A. No cutting is to be done at points or in a manner that will weaken the structure and unnecessary cutting must be avoided. If in doubt, contact the Engineer.
- B. Conduit openings in slabs and walls shall be cut with core drill. Hammer devices will not be permitted. Edges of trenches and large openings shall be scribe cut with a masonry saw.
- C. X-ray concrete slabs and walls prior to core drilling. Do not core drill through rebar, steel or reinforcing material without written permission from the Structural Engineer and Architect.
- D. Openings in metal building walls shall be made in strict accord with building suppliers recommendations.

3.3 PATCHING AND REPAIRING

- A. Patching and repairing made necessary by work performed under this division shall be included as a part of the work and shall be done by skilled mechanics of the trade or trades for work cut or damaged, in strict accordance with the provisions herein before specified for work of like type to match adjacent surfaces and in a manner acceptable to the Engineer.
- B. Where portions of existing lawns, shrubs, paving, etc. are disturbed for installation of work of this Division, such items shall be repaired and/or replaced to the satisfaction of the Engineer.

- C. Where the installation of conduit, raceways, etc. requires the penetration of fire or smoke rated walls, ceilings or floors, the space around such conduit, raceways, etc., shall be tightly filled with an approved non-combustible fire insulating material satisfactory to maintain the rating integrity of the wall, floor or ceilings affected.
- D. Conduits passing through floors, ceilings and walls in finished areas, unless otherwise specified, shall be fitted with chrome plated brass escutcheons of sufficient outside diameter to amply cover the sleeved openings and an inside diameter to closely fit the conduit around which it is installed.
- E. Stainless steel collars shall be provided around all conduits, raceways, etc., at all wall penetrations; both sides where exposed.
- F. Where conduits pass through interior or exterior walls, the wall openings shall be sealed air tight. This shall include sealing on both sides of the wall to insure air does not enter or exit the wall cavity. This is especially critical on exterior walls where the wall cavity may be vented to the exterior.

END OF SECTION

DIVISION 26 – ELECTRICAL

SECTION 260505 – EXCAVATION, TRENCHING, BACKFILLING AND GRADING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General, Special and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.
- B. The Contractor is directed to examine each and every section of these specifications, all drawings relating to the Contract Documents, any and all Addenda, etc., for work described elsewhere that may relate to the provision of the work described herein. Materials and performance requirements are specified elsewhere herein that relate to these systems.
- C. Each Electrical Contractor's attention is directed to Section 260501 - General Provisions, Electrical, and all other Contract Documents as they apply to his work.

1.2 SUMMARY

- A. Each Contractor shall include all excavating, filling, grading and related items required to complete his work as shown on the drawings and specified herein.
- B. Electrical distribution lines and underground telephone or TV cables shall, in no case, be placed in the same trench with sanitary, storm, domestic or fire protection water lines. Telephone or cable TV services shall, in all cases, be placed in a separate trench with minimum two feet separation from electrical power lines.
- C. Depths of bury shall be:
 - 1. 48" minimum to top of primary ducts, unless otherwise noted.
 - 2. 42" minimum to top of secondary ducts, unless otherwise noted.
 - 3. 36" minimum to top of branch exterior circuits, unless otherwise noted.
 - 4. 36" minimum to top of fiber/telephone/communication/misc. ducts, unless otherwise noted.

1.3 SUBSURFACE DATA

- A. Subsurface investigations have been made and the results shown on the drawings. The information was obtained primarily for use in preparing foundation design. Each Contractor may draw his own conclusions therefrom. No responsibility is assumed by the Owner for subsoil quality or conditions other than at the locations and at the time investigations were made.
- B. Materials to be excavated shall be unclassified, and shall include earth, rock, or any other material encountered in the excavation to the depth and extent indicated on the drawings and specified herein. No adjustment in the Contract sum will be made on account of the presence or absence of rock, shale, or other materials encountered in the excavating.

1.4 BENCH MARKS AND MONUMENTS

- A. Maintain carefully all bench marks, monuments and other referenced points. If disturbed or destroyed, replace as directed.

PART 2 - PRODUCTS

PART 3 - EXECUTION

3.1 EXCAVATION

- A. Each Contractor shall accept the site as he finds it and remove all trash, rubbish and material from the site prior to starting excavation for his work.
- B. Excavate trenches to sufficient width and depth for proper installation of the work and where required, smooth the bottom on the trench with hand tools in strict accordance with OSHA Guidelines.
- C. The removal of rock shall be accomplished by use of hand or power tools only. Blasting shall not be permitted unless authorized in writing by the Architect. Any damage to existing structures, exterior services or rock intended for bearing, shall be corrected at the responsible Contractor's expense.
- D. Keep trenches free from water while construction therein is in progress. Under no circumstances lay conduit or cable in water. Pumping or bailing water from this Contractor's trenches, which is required during construction shall be accomplished at his expense.
- E. In no case shall excavation work be accomplished that will damage in any way the new structure, existing structures, equipment, etc. Each Contractor shall take the necessary steps to prevent flow of eroded earth by water or landslide onto the property of others, or against the structures. The repair of all such damage, or any other damage incurred in the course of excavation, shall be borne by the responsible Contractor. Restore all disturbed areas to original condition.

3.2 BACKFILL

- A. Concrete for concrete encasement shall cure a minimum of 3 days prior to backfill.
- B. Backfill shall be accomplished with clean debris free earth and the backfill compacted to 95% standard Proctor in 6" lifts so as to avoid earth sinks along the trench. The responsible Contractor will be required to return to the project and fill any sunken areas along the route of his work.
- C. Backfill trenches only after conduit and cable have been inspected by Agencies, Engineer and Owner, tested, and locations of pipe lines have been recorded on record drawings. Provide at least one week's written or fax notification to all parties of impending work that needs to be reviewed.
- D. The backfill below paved areas shall be sand and brought to proper grade in 6" lifts compacted to 98% standard Proctor to receive the sub-base and paving. No paving shall be placed on uncompacted fill.
- E. The backfill below sodded or seeded areas shall be brought to within six inches of finished grade. The remaining six inches shall be backfilled with clean soil.

END OF SECTION

DIVISION 26 – ELECTRICAL

SECTION 260506 – DEMOLITION, RESTORATION AND SALVAGE

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General, Special and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.
- B. The Contractor is directed to examine each and every section of these specifications, all drawings relating to the Contract Documents, any and all Addenda, etc., for work described elsewhere that may relate to the provision of the work described herein. Materials and performance requirements are specified elsewhere herein that relate to these systems.
- C. Each Electrical Contractor's attention is directed to Section 260501 - General Provisions, Electrical, and all other Contract Documents as they apply to his work.

1.2 SUMMARY

- A. This section includes electrical demolition, patching, disposal and salvaging requirements.
- B. This Section includes all labor, material, equipment and services necessary and incidental to complete all the demolition and removal of electrical work as shown on the Drawings or as required.
- C. The demolition drawings do not necessarily indicate all the conditions, details, or work required. The Contractor shall examine the building to determine the actual conditions and extent of the work. Any details not clear to this Contractor shall be referred to the Architect/Engineer for clarification prior to bidding.
- D. The Contractor shall be responsible for demolition and removal of all existing electrical systems where shown for demolition. No portion of electrical systems shown for demolition may be abandoned in place.

1.3 DESCRIPTION OF WORK

- A. This section covers all demolition, restoration and salvage required to perform the electrical work indicated on the drawings, specified and/or as required to complete the project. It is the intent of this section of work to remove all existing electrical equipment, materials, etc. which are not required for the completed building and to restore any and all finished surfaces to their original type and conditions. To accomplish these requirements, the Contractor(s) shall, at his own expense, engage the services of others already performing finish work on this project. All work shall be completed to the satisfaction of the Architect/Engineers whose decisions shall be final. This requirement shall apply to all restoration work whether indicated or specified.
- B. Electrical Contractor shall re-pull new wire/cable to all devices and equipment that have been cut-off from a panelboard or electronics due to demolition work. Contractor shall check/test all devices and verify they are functional.
- C. All adjacent areas need to remain in operation and services to other areas need to be maintained during demolition.
- D. Schedule all demolition and any outages affecting other areas with owner.
- E. Provide and maintain temporary partitions and/or dust barrier per Owner's dust control plan.

1.4 SCHEDULING

- A. Schedule work to coincide with new construction.
- B. Cease operations immediately when structure appears to be in danger and notify Architect. Do not resume operations until directed.

1.5 QUALITY ASSURANCE

- A. Comply with NFPA, NEC and OSHA requirements.
- B. Contractor shall verify the extent of the demolition work. Any questions as to which systems are to be removed versus which systems are to remain shall be referred to the Architect/Engineer for clarification prior to commencing demolition work.
- C. The demolition work shall be a phased operation and shall comply with the construction sequence schedule. The Contractor shall submit a schedule of demolition work 14 days prior to the start of work. The Contractor shall not proceed with the work until receiving written approval.

1.6 SEQUENCING AND SCHEDULING

- A. Coordinate electrical system demolition with other systems being demolished.

1.7 SITE SURVEY

- A. Before submitting bid, bidder shall carefully examine existing field conditions, including the main power and power distribution system. Claims for extra labor, equipment and materials required due to existing conditions, which could have been foreseen, will not be recognized.

1.8 ELECTRICAL

- A. Where electrical fixtures, equipment or other materials are removed and/or relocated, all abandoned conduit and conductors shall be removed in exposed areas. In concealed areas, materials shall be abandoned in place or removed as indicated and patch all openings. Contractor shall remove all conduit, wire, connections, etc. for electrical items being demolished. Contractor shall maintain continuity of existing circuits where removed items do not represent the complete circuit and devices. Field verify exact requirements.
- B. The Contractor shall be responsible for the removal and/or relocation of any electrical equipment, fixtures, devices, appurtenances, etc. which may, in the course of construction, interfere with the installation of any new and/or relocated Architectural, Mechanical, Electrical, Structural or Fire Protection Systems whether indicated or not.
- C. Relocate junction boxes and provide low-voltage raceways and supports for existing cabling in areas above new inaccessible ceilings.
- D. Where components of any system in this Contractor's scope of work are to be reused, the contractor shall test those components prior to removal and record the state of functionality and condition of the components as tested. These records shall be provided to the owner or engineer upon request. In the absence of these records, all components removed shall be assumed functional at the time of removal. Any device subsequently found to be non-functioning or in unsuitable condition for reuse shall be replaced at the expense of the contractor.

1.9 REPAIR

- A. Unless otherwise indicated, the Contractor shall be responsible for the patching and repairing of all holes, etc. in the ceiling, wall and floors where electrical equipment is removed. Patching shall be accomplished with similar materials to the existing ceilings, walls and floors and shall match adjacent surfaces.

1.10 COORDINATION

- A. Conduct demolition to minimize interference with adjacent and occupied building areas.
- B. Coordinating and sequence demolition so as not to cause shutdown of operation of surrounding areas.
- C. Coordinate demolition of all affected electrical systems to prevent disruption to the Owner and minimize downtime.
- D. Coordinate demolition by other Divisions of the Specifications to prevent disruption to the Owner and minimize the downtime.

PART 2 - PRODUCTS

2.1 MATERIALS AND EQUIPMENT

- A. Materials and equipment for patching and extending work: As specified in individual Sections.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verify wiring and equipment indicated to be demolished serve only abandoned facilities.
- B. Verify termination points for demolished services.
- C. Verify field measurements and circuiting arrangements are as shown on Drawings.
- D. Verify that abandoned wiring and equipment serve only abandoned facilities.
- E. Demolition Drawings are based on casual field observation and existing record documents. Report discrepancies to Architect/Engineer before disturbing existing installation.
- F. Beginning of demolition means installer accepts existing conditions.

3.2 DOCUMENTATION

- A. Contractor is responsible for submitting photos and documenting existing conditions to Owner prior to commencing demolition. Systems and equipment found to be defective after demolition has commenced shall be repaired or replaced by Contractor at no additional cost to Owner.

3.3 PREPARATION

- A. Erect, and maintain temporary safeguards, including warning signs and lights, barricades, and similar measures, for protection of the public, Owner, Contractor's employees, and existing improvements to remain.
- B. All existing computer equipment racks and open or closed raceways must be covered before start of Work.
- C. Use temporary egress signage and emergency lighting as needed.
- D. Thoroughly examine, review and document all existing infrastructure conditions to determine use. Submit plan to Owner detailing all planned modifications to existing conditions and new work. Owner shall provide written approval to Contractor before proceeding with work.
- E. Disconnect electrical systems in walls, floors, and ceilings scheduled for removal.
- F. Provide temporary wiring and connections to maintain existing systems in service during construction. When work must be performed on energized equipment or circuits, use personnel experienced in such operations.

3.4 DEMOLITION

- A. Protect existing electrical equipment and installations indicated to remain. If damaged or disturbed in the course of the Work, remove damaged portions and install new products of equal capacity, quality, and functionality.
- B. Remove demolished material from Project site, except as indicated on drawings.
- C. Remove all existing concrete pads supporting electrical equipment complete. Existing concrete pads shall not be re-used.
- D. Remove abandoned wiring to source of supply.
- E. Remove exposed abandoned conduit, including abandoned conduit above accessible ceiling finishes. Cut conduit flush with walls and floors, and patch surfaces.

- F. Disconnect abandoned outlets and remove devices. Remove abandoned outlets if conduit servicing them is abandoned and removed. Provide blank cover for abandoned outlets which are not removed.
- G. Remove, store, clean, reinstall, reconnect, and make operational components indicated for relocation.
- H. Remove abandoned conduit, wire, boxes, and fastening devices including abandoned conduit, wire, boxes, and fastening devices above accessible ceiling finishes. Cut conduit flush with walls and floors, and patch surfaces.
- I. Remove conduit, wire, boxes, and fastening devices to avoid any interference with new installation.
- J. Reconnect equipment being disturbed by renovation work and required for continued Service.
- K. Disconnect or shut-off service to areas where electrical work is to be removed. Remove electrical fixtures, equipment, and related switches, outlets, conduit and wiring that are not part of final project.
- L. Install temporary wiring and connections to maintain existing systems in service during construction.
- M. Perform work on energized equipment or circuits with experienced and trained personnel.
- N. Remove, relocate, and extend existing installations to accommodate new construction.
- O. Repair adjacent construction and finishes damaged during demolition and extension work.
- P. Remove exposed abandoned grounding and bonding components, fasteners and supports, and electrical identification components, including abandoned components above accessible ceiling finishes and below raised floor areas. Cut embedded support elements flush with walls and floors.
- Q. Clean and repair existing equipment to remain or to be reinstalled.
- R. Protect and retain power to existing active equipment remaining.
- S. Cap abandoned empty conduit at both ends.
- T. Repair adjacent construction and finishes damaged during demolition and extension work. T-bar ceiling tiles damaged under normal construction conditions or having voids where junction boxes were removed shall be replaced by the Contractor.
- U. Maintain access to existing electrical installations which remain active.
- V. Where materials or equipment are to be turned over to Owner or reused and installed by the Contractor, it shall be the Contractor's responsibility to maintain condition of materials and equipment equal to the existing condition of the equipment before the work began. Repair or replace damaged materials or equipment at no additional cost to the Owner.

3.5 EXISTING PANELBOARDS

- A. Ring out circuits in existing panel affected by the Work. Where additional circuits are needed, reuse circuits available for reuse. Install new breakers.
- B. Disconnect and tag unused circuits as spare.
- C. Where existing circuits are indicated to be reused, use sensing measuring devices to verify circuits feeding Project area or are not in use.
- D. Remove existing wire no longer in use from panel to equipment.
- E. Provide new updated directories where circuits have been modified or rewired.

3.6 LAMP DISPOSAL

- A. Contractor shall be responsible for the careful removal of all lamps and fluorescent tubes without breakage from existing lighting fixtures.

- B. Lamps removed from fluorescent, metal halide, mercury vapor, and sodium fixtures shall be placed by the Contractor in cardboard boxes. The Contractor shall label each box with type and quantity of lamps in each box and seal the box. Boxes shall be properly disposed of by the Contractor.
- C. Broken, fluorescent, metal halide, mercury vapor, and sodium lamps without green end caps shall be immediately and carefully cleaned up by the Contractor and placed in a 55 gallon steel drum. 55 gallon steel drums shall properly dispose of by the Contractor.
- D. All incandescent lamps shall be disposed of by the Contractor in his dumpster.

3.7 MASONRY UNIT REMOVAL AND REPLACEMENT

- A. Carefully demolish or remove entire concrete masonry unit (CMU) block face from joint to joint, without damaging surrounding masonry, in a manner that permits replacement with new full-size CMU block face.
- B. Support and protect remaining masonry that surrounds removal area. Maintain flashing, reinforcement, lintels, and adjoining construction in an undamaged condition.
- C. Clean CMU surrounding removal areas by removing mortar, duct, and loose particles in preparation for replacement.
- D. Install replacement CMU into bonding and coursing pattern of existing units. If cutting is required, use a motor-driven saw designed to cut masonry with clean, sharp, unchipped edges.
- E. Lay replacement units with completely filed bed, head, and collar joints. Butter ends with sufficient mortar to fill head joints and shove into place. Wet both replacement and surrounding masonry that has ASTM C67 initial rates of absorption of more than 30 g/30 sq. in. per min. Use wetting methods that ensure that units are nearly saturated but surface is dry when laid. Maintain joint width for replacement units to match existing joints.
- F. Tool exposed mortar joints in repaired areas to match joints of surrounding existing masonry.
- G. Rake out mortar used for laying masonry before mortar sets and point new mortar joints in repaired area to comply with requirements for repointing existing masonry, and at the same time as repointing of surrounding area.
- H. After mortar has fully hardened, thoroughly clean exposed masonry surfaces of excess mortar and foreign matter; use wood scrapers, stiff-nylon or fiber brushes, and clean water, spray applied at low pressure. Do not use metal scrapers or brushes. Do not use acidic or alkaline cleaners.
- I. Wash adjacent non-masonry surfaces. Use detergent and soft brushes or cloths suitable for surface material being cleaned.
- J. Sweep and rake adjacent pavement, concrete and ground to remove masonry debris. Where necessary, pressure wash surfaces to remove mortar, dust, dirt and stains.

3.8 SALVAGE

- A. It is the intent of this section to deliver to the Owner all components of any electrical system (including fire alarm systems) which they may want to salvage. The Contractor shall make every effort to remove reusable components without damage. Coordinate removal with the owner and deliver to maintenance all items the owner requests from demolition. These items typically include switchgear, fire alarm system, public address system, etc.
- B. All salvaged equipment shall be delivered to Owner.

3.9 REUSABLE ELECTRICAL EQUIPMENT

- A. Carefully remove equipment, materials, or fixtures that are to be reused.
- B. Disconnect, remove, or relocate existing electrical material and equipment interfering with new installation.

- C. Relocate existing lighting fixtures as needed. Test fixture to see if it is in good working condition before installation at new location. Disconnect or shut off service to areas where electrical work is to be removed. Remove electrical fixtures, equipment, and related switches, outlets, conduit and wiring that are not part of final project.

3.10 CLEANING AND REPAIR

- A. Remove demolished materials as work progresses. Legally recycle or dispose.
- B. Keep workplace neat on a daily basis.
- C. Clean and repair existing materials and equipment which remain or are to be reused.

END OF SECTION

SECTION 260508 - COORDINATION AMONG TRADES, SYSTEMS INTERFACING AND CONNECTION OF EQUIPMENT FURNISHED BY OTHERS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General, Special and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.
- B. The Contractor is directed to examine each and every section of these specifications, all drawings relating to the Contract Documents, any and all Addenda, etc., for work described elsewhere that may relate to the provision of the work described herein. Materials and performance requirements are specified elsewhere herein that relate to these systems.
- C. Each Electrical Contractor's attention is directed to Section 260501 - General Provisions, Electrical, and all other Contract Documents as they apply to his work.

1.2 COORDINATION

- A. The Contractor is expressly directed to read the General Conditions and all sections of these specifications for all other trades and to study all drawings applicable to his work, including Architectural, Plumbing, Fire Protection, Mechanical and Structural drawings, to the end that complete coordination between trades will be affected. Each Contractor shall make known to all other contractors the intended positioning of materials, raceways, supports, equipment and the intended order of his work. Coordinate all work with other trades and proceed with the installation in a manner that will not create delays for other trades or affect the Owner's operations.
- B. Special attention to coordination shall be given to points where raceways, fixtures, etc., must cross other ducts or conduit, where lighting fixtures must be recessed in ceilings, and where fixtures, conduit and devices must recess into walls, soffits, columns, etc. It shall be the responsibility of each Contractor to leave the necessary room for other trades. No extra compensation or time will be allowed to cover the cost of removing fixtures, devices, conduit, ducts, etc. or equipment found encroaching on space required by others.
- C. The Contractor shall be responsible for coordination with all trades to insure that they have made provision for connections, operational switches, disconnect switches, fused disconnects, etc., for electrically operated equipment provided under this or any other division of the specifications, or as called for on the drawings. Any connection, circuiting, disconnects, fuses, etc. that are required for equipment operation shall be provided as a part of this contract.
- D. If any discrepancies occur between accompanying drawings and these specifications and drawings and specifications covering other trade's work, each trade shall report such discrepancies to the Architect far enough in advance so that a workable solution can be presented. No extra payment will be allowed for relocation of fixtures, devices, conduit, and equipment not installed or connected in accordance with the above instructions.
- E. In all areas where air diffusers, devices, lighting fixtures and other ceiling-mounted devices are to be installed, the Mechanical Trade(s), the Electrical Trade and the General Trades shall coordinate their respective construction and installations so as to provide a combined symmetrical arrangement that is acceptable to the Architect and Engineer. Where applicable, refer to reflected ceiling plans. Request layouts from the Architect or Engineer where in doubt about the potential acceptability of an installation.

1.3 INTERFACING

- A. Each Electrical Trade, Specialty Controls Trade, Mechanical Trade and the General Trades, etc., shall insure that coordination is effected relative to interfacing of all systems. Some typical interface points are (but not necessarily all):
 - 1. Connection of all controls to equipment.

2. Electrical power connections to electrically operated (or controlled) equipment.
3. Electrical provisions for all equipment provided by other trades or suppliers within this contract.
4. Contractor is to provide conduit whips and back boxes, as needed, to power systems furniture.
5. Coordination of connection of Telecommunications (voice, data, video) lines to Owner's existing or new service.

1.4 CONNECTION OF EQUIPMENT FURNISHED BY OTHERS

- A. Each Contractor shall make all connections to equipment furnished by others, whenever such equipment is shown on any part of the drawings or mentioned in any part of the Specifications, unless otherwise specifically specified hereinafter.
- B. All drawings are complementary, one trade of the other. It is the Contractor's responsibility to examine all drawings and specifications to determine the full scope of his work. The project Engineers have arranged the specifications and drawings in their given order solely as a convenience in organizing the project, and in no way shall they imply the assignment of work to specific trades, contractors, subcontractors or suppliers.
- C. Supervision to assure proper installation, functioning and operation shall be provided by the Contractor furnishing the equipment or apparatus to be connected.
- D. Items indicated on the drawings as rough-in only (RIO) will be connected by the equipment supplier or Owner, as indicated. The Contractor shall be responsible for rough-in provisions only as indicated. These rough-ins shall be in accord with the manufacturer's or supplier's requirements.
- E. For items furnished by others, relocated, or RIO, the Contractor shall obtain from the supplier or shall field determine as appropriate, the exact rough-in locations and connection sizes for the referenced equipment.
- F. The Contractor shall be responsible for coordinating with the General and all other trades, as necessary, to determine any and all final connections that he is to make to equipment furnished by others.
- G. Sides of cable, basket and ladder trays shall not be obstructed with special attention to pipes, ductwork, raceways, equipment, cables, etc.

END OF SECTION 260508

DIVISION 26 - ELECTRICAL

SECTION 260510 – DESCRIPTION OF ELECTRICAL SYSTEM

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General, Special and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.
- B. The Contractor is directed to examine each and every section of these specifications, all drawings relating to the Contract Documents, any and all Addenda, etc., for work described elsewhere that may relate to the provision of the work described herein. Materials and performance requirements are specified elsewhere herein that relate to these systems.
- C. Each Electrical Contractor's attention is directed to Section 260501 - General Provisions, Electrical, and all other Contract Documents as they apply to his work.

1.2 PRIMARY ELECTRICAL SERVICE

- A. Primary electrical service shall be underground utility company service to a pad-mount transformer as indicated on the plans. Refer to Power Distribution Riser Diagram for additional requirements.
- B. The Electrical Contractor shall provide primary conduit, extension connections, concrete transformer pads, pull ropes, C/T installation and trenching in accord with Utility Company requirements.
- C. In general, the electrical utility company will provide the pad-mounted transformer, primary cable and its terminations.
- D. Conduits routed off the property and connected to or near a manhole or pole and all other work shall be in accord with utility company requirements. Contact the utility company prior to bidding the work and include any and all charges for their work in bid.

1.3 SECONDARY SERVICE LATERAL

- A. Secondary service shall be 120/208V/3Ø/4W with solid grounded neutral. Refer to Power Distribution Riser Diagram for additional requirements.
- B. Electrical Contractor shall provide the trench, backfill, conduit, lugs, conductors, meter base and CT cabinet per utility company standards.

1.4 ADDITIONAL UTILITY COMPANY REQUIREMENTS

- A. The Contractor shall provide the local utility company with a drawing produced by a licensed Land Surveyor acceptable to the utility that locates the centerline of the primary duct. Coordinate further requirements with utility company.
- B. Contact the utility company for specifics on construction of pads, conduit, etc., prior to bidding the work and determine all their requirements. All work shall be in accord with their standards.
- C. The Electrical Contractor is responsible for the temporary electrical service, fees and bills.
- D. The Electrical Contractor is responsible for all fees, permit costs, etc., from the electrical utility company and the telephone company. This includes any cost to associated with the underground electrical service extension.
- E. The Electrical Contractor will pay utility company fees for the new primary cabling, pad mounted service transformer and primary cabling terminations.

- F. Each Contractor, prior to bidding the work, is to contact the electrical utility company (as well as the telephone and cable TV utility company) and determine the exact points of extension of all underground services in the field with a representative of each utility company. Also, obtain construction details on manholes, transformer pads, pedestal stub-ups, etc., from each utility company as applicable. Extension points indicated on the plans are approximate, and are given for the bidder's information only.

END OF SECTION

DIVISION 26 – ELECTRICAL

SECTION 260519 – LOW-VOLTAGE ELECTRICAL POWER, CONDUCTORS, CABLES, SPLICING DEVICES AND CONNECTORS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General, Special and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.
- B. The Contractor is directed to examine each and every section of these specifications, all drawings relating to the Contract Documents, any and all Addenda, etc., for work described elsewhere that may relate to the provision of the work described herein. Materials and performance requirements are specified elsewhere herein that relate to these systems.
- C. Each Electrical Contractor's attention is directed to Section 260501 - General Provisions, Electrical, and all other Contract Documents as they apply to his work.

1.2 SUMMARY

- A. This Section includes the following:
 - 1. Building wires and cables rated 600 V and less.
 - 2. Connectors, splices, and terminations rated 600 V and less.
- B. This section of the Specifications covers all of the electrical power, lighting, and control power (line voltage) conductors, but does not include communications, data or signal system conductors, which are specified separately in these specifications.
- C. All conduits installed without conductors shall have a 200 lb. test nylon string installed for future use, tied off securely at each end.
- D. No more than 40% conduit fill permitted for any conduit system, including video, intercom, data, voice, power or other signal circuits unless specifically indicated otherwise on the plans.
- E. No more than seven conductors (six current-carrying and one ground) shall be installed in a conduit except for switch legs and travelers in multi-point switching arrangements. Multi-wire branch circuits with a shared neutral are not allowed.
- F. If multiple circuits are pulled in a single homerun, a dedicated neutral shall be provided for each phase conductor. In these cases, a maximum of seven conductors (six current carrying and one ground) are permitted in a single conduit. Conductors shall be derated per NEC.
- G. Intentional or unintentional painting of exposed low-voltage and/or line-voltage cabling is prohibited. The contractor shall ensure that exposed cabling is adequately protected from direct painting or overspray whether painting is required within the electrical specifications or required by other disciplines/trades. The contractor shall review the painting requirements for all disciplines and shall provide cabling protection as required. Where exposed cabling is being installed in exposed ceiling or wall spaces that are required to be painted, the contractor shall provide alternate options for cable colors and shall provide submittals for such cabling to engineer for approval.

1.3 ACTION SUBMITTALS

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

1.4 INFORMATIONAL SUBMITTALS

- A. Coordinate paragraph below with qualification requirements in Division 01 Section "Quality Requirements" and as supplemented in "Quality Assurance" Article.
- B. Qualification Data: For testing agency.
- C. Field quality-control test reports.

1.5 QUALITY ASSURANCE

- A. Testing Agency Qualifications: An independent agency, with the experience and capability to conduct the testing indicated, that is a member company of the InterNational Electrical Testing Association or is a nationally recognized testing laboratory (NRTL) as defined by OSHA in 29 CFR 1910.7, and that is acceptable to authorities having jurisdiction.
 - 1. Testing Agency's Field Supervisor: Person currently certified by the InterNational Electrical Testing Association or the National Institute for Certification in Engineering Technologies to supervise on-site testing specified in Part 3.
- B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
- C. Comply with NFPA 70.

PART 2 - PRODUCTS

2.1 CONDUCTORS AND CABLES

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - 1. Alcan Products Corporation; Alcan Cable Division.
 - 2. Alpha Wire Company.
 - 3. American Insulated Wire Corp.; a Leviton Company.
 - 4. Belden Inc.
 - 5. Cerro Wire LLC.
 - 6. Encore Wire Corporation.
 - 7. General Cable Technologies Corporation.
 - 8. General Cable Corporation.
 - 9. Senator Wire & Cable Company.
 - 10. Southwire Company.
- B. All conductors shall be 98% conductive annealed copper unless otherwise noted, UL listed and labeled. Comply with ANSI/NEMA WC 70/ICEA S-95-658.
- C. Conductor Insulation:
 - 1. Comply with ANSI/NEMA WC 70/ICEA S-95-658.
 - 2. Lighting and receptacle branch circuits shall be Type THW, THHN or THWN insulation.
 - 3. All feeders shall be Type THW or THWN of the size as shown on the Contract Drawings.
 - 4. THHN wiring shall only be installed in overhead, dry or damp locations.
 - 5. THWN OR THW wiring shall be used for all circuits pulled in underground or other wet locations.
- D. Conductor sizes indicated on drawings are based upon 75 degree C rating.
- E. Minimum branch circuit or feeder size shall be not less than #12 AWG copper wire or of the sizes shown on the drawings.

- F. All conductors shall be stranded.
- G. Designer Note: Remove sentence requiring plenum fire alarm cable if installed in conduit. Remove sentence requiring conduit if exposed plenum cable is acceptable.
- H. Conductors for fire alarm wiring shall be stranded and in full compliance with NEC 760. All fire alarm conductors shall be installed within conduit and enclosed junction boxes. Exposed cabling in air plenums shall be rated for plenum installation.
- I. All wire on the project shall be new, in good condition, and shall be delivered in standard coils or reels.
- J. The color of the wire shall be selected to conform to Section 210-5 of the latest edition of the National Electrical Code. Power conductors of all sizes shall follow the color coding scheme listed under PART 3, IDENTIFICATION below.
- K. Conductors used for motor connections and connections to vibrating or oscillating equipment shall be extra flexible.
- L. Conductors for main ground from neutral bus, equipment grounding bus, building steel, grounding grid and main cold water pipe connection shall be bare copper.
- M. All conductors shall be identified by color code and by means of labels placed on conductors in all junction boxes and at each terminal point with Brady, Ideal, T & B or approved equivalent labels indicating source, circuit number or terminal number.
- N. All feeders and branch circuits shall be installed and sized for a maximum 2% voltage drop. As calculated using 80% of the supply breaker rating as the load. Adjust conductors and conduit size accordingly for actual field installed conditions.
- O. For 120VAC, 20AMP branch circuits:
 - 1. #12 AWG when run is 50 feet or less;
 - 2. #10 AWG when run is between 50 feet and 100 feet;
 - 3. #8 AWG when run is more than 100 feet.
- P. MC cable may be used for normal power branch circuits, #10 and smaller, where concealed in walls, above ceilings, etc. MC cable shall not be used for emergency power circuits, any feeders, any exposed locations, or any wiring larger than #10. Supports shall be per NEC and all runs shall be parallel or perpendicular to building lines with right angle turns. Cables shall be bundled where run in groups using listed supports. Do not route through structure or on work of other trades. Provide independent supports directly from structure. All MC cable which serves patient care areas shall be type HCF, rated for healthcare use and shall have insulated ground wire and grounded sheath. HCF cable shall be NEMA WC 70 compliant, UL 4 and 1479 listed, with green exterior sheath.
- Q. MC cable is acceptable for the following applications:
 - 1. Feeders for lighting fixture whips and for branch circuits concealed in walls and partitions only. Locate junction box and convert to single conductors in rigid raceway within the same room as where the cable enters/exits the wall.
 - 2. Use only for single-circuit cable (i.e. two wire plus ground). For devices in the same wall connected to different circuits, install separate single circuit cable for each circuit.
 - 3. The MC cable length for power circuits shall be limited to 30' from the junction box to the wiring device located in the wall. If the circuit continues outside the wall, the circuit must immediately transition to conduit.
 - 4. The MC cable length for lighting circuits shall be limited to 30' from the junction box to the first fixture and from that point only those fixtures above the enclosed space/room shall be served by this HCF circuit.
- R. MC cable is not acceptable for the following applications:
 - 1. Homeruns to Panelboards.

2. Branch circuits serving Essential Electrical System (Emergency & Standby) loads; including Life Safety branch, Critical branch and equipment emergency system.
3. Branch circuits serving HVAC, elevator/escalator, medical and kitchen equipment loads.
4. Within mechanical, electrical or telecommunication equipment rooms.
5. Exposed Branch Circuits within areas that do not have a ceiling (i.e. open to structure).
6. Wet locations.

2.2 SPLICING DEVICES & CONNECTORS

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
1. 3M; Electrical Products Division.
 2. AFC Cable Systems, Inc.
 3. Burndy
 4. Gardner Bender.
 5. Hubbell Power Systems, Inc.
 6. Ideal Industries, Inc.
 7. ILSCO.
 8. NSi Industries LLC.
 9. O-Z/Gedney; an EGS Electrical Group brand; an Emerson Industrial Automation business.
 10. Reliable
 11. T&B
 12. Tyco Electronics Corp.
- B. Description: Factory-fabricated connectors and splices of size, ampacity rating, material, type, and class for application and service indicated.
- C. Splicing devices for use on #10 AWG and smaller conductors shall be pressure type such as T&B "Sta-Kon".
- D. Wire nuts shall be spring pressure type, insulation 600V, 105°C insulation, up to #8 AWG. Greater than #6 AWG shall be a compression type connection, 600V insulation, cold shrink tubing, taped to restore full insulation value of the wire being spliced.
- E. Pressure crimp-applied ring type (or fork with upturned ends) terminations shall be employed on motor and equipment terminals where such terminals are provided on motor and equipment leads or on all stranded wire terminations using #10 AWG or smaller conductors.
- F. Splices, where necessary, shall be made with hydraulically-set "Hy-press" or equivalent crimped connectors. All splices shall be insulated to the full value of the wiring insulation using a cold-shrink kit or the equivalent in built-up materials.
- G. Large connectors (lugs) at terminals shall be mechanical type, hex-head socket or crimp-on style, installed per the manufacturer's recommendations.
- H. Underground connections made between bare ground wires or to ground rods shall be exothermically welded, "Cadweld" or equivalent.
- I. No aluminum splicing devices or connectors shall be used.

PART 3 - EXECUTION

3.1 CONDUCTOR AND INSULATION MATERIAL APPLICATIONS

- A. Feeders and Branch Circuits: Copper. Solid for #10 AWG and smaller; stranded for # 8 AWG and larger.
- B. Conductors used for motor connections and connections to vibrating or oscillating equipment shall be extra flexible stranded.

- C. Lighting and receptacle branch circuits shall be Type THW, THHN or THWN insulation.
- D. All feeders shall be Type THW or THWN of the size as shown on the Contract Drawings.
- E. THHN wiring shall only be installed in overhead, dry or damp locations.
- F. THWN or THW wiring shall be used for all circuits pulled in underground or other wet locations.
- G. Class 1 Control Circuits: Type THHN-THWN, in raceway.
- H. Motor Connections shall use connection lugs with motor stub splice insulators.
- I. Cord Drops and Portable Appliance Connections: Type SO, hard service cord with stainless-steel, wire-mesh, strain relief device at terminations to suit application.

3.2 INSTALLATION

- A. Clean out raceway system before pulling conductors.
- B. Use manufacturer-approved pulling compound or lubricant where necessary; compound used must not deteriorate conductor or insulation. Do not exceed manufacturer's recommended maximum pulling tensions and sidewall pressure values.
- C. Use pulling means, including fish tape, cable, rope, and basket-weave wire/cable grips, that will not damage cables or raceway.
- D. The pulling of all wires and cable on this project shall be performed in strict compliance with applicable sections of the National Electrical Code. No conductor entering or leaving a cabinet or box shall be deflected in such a manner as to cause excess pressure on the conductor insulation. Conductors shall only be installed after insulating bushings are in place.
- E. The radius of bending of conductors shall be not less than eighteen times the outside diameter of the conductor insulation or more, if recommended by the manufacturer.
- F. Conductors installed within environmental air plenums shall be per NEC. Article 800 and other applicable codes, with FEP-type insulation or an approved equivalent. Also provide plenum-rated tie-wraps where plastic straps or other supports, etc., are installed in plenum areas.
- G. Where indicated, systems and control conductors that are installed exposed shall not be routed across ceilings or ductwork. They shall be held up against building structure or against permanent support members. They shall be installed in such a manner that they do not interfere with the access to or operation of equipment or removal of ceiling tiles. Nylon tie-wraps shall be installed in such a manner so as to bundle conductors neatly, allowing runouts of single conductors or groups to drop down to equipment served. Install grommeting where dropping out of trays or into panels or service columns. Install sleeves with bushings where penetrating partitions. Firestop sleeves with approved material. Do not penetrate firewalls if so indicated on plans. Refer to the drawings for support requirements and details on routing exposed communications conductors.
- H. Conductors for isolated power systems shall be installed in as short a run of conduit as practicable. No pulling soap shall be used on conductors in isolated power systems.
- I. Where conductors are installed in industrial facilities, they shall be per JIC standards.
- J. Maximum permissible pulling tensions, as recommended by the manufacturer for any given type of cable or wire installed shall not be exceeded. Utilize special remote readout equipment to ensure compliance. Use particular caution when installing twisted pair data cable or fiber optic cables -- forces permitted for pulling in are typically very low for these cable types.
- K. All cables and wiring, regardless of voltage, installed in manholes or cable vaults shall be routed in such a manner to provide a minimum of 6 feet of slack cable for future splicing. Install cables along walls by utilizing the longer route from entry to exit. If both routes are symmetrical, provide a loop of cable

secured to wall. All cables shall be tied to insulated cable supports on wall-mounted racks, spaced a maximum of three feet apart.

- L. Where multi-wire branch circuits are allowed on the drawings, the phases and neutral shall be wire-tied together in the panelboard and in all pull boxes.

3.3 CONNECTIONS

- A. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.
- B. Make splices and taps that are compatible with conductor material and that possess equivalent or better mechanical strength and insulation ratings than un-spliced conductors.
- C. Wiring at Outlets: Install conductors at each outlet with at least 12 inches of slack.

3.4 IDENTIFICATION

- A. Color coding distribution voltage conductors, 600 volts or less
- B. Conductors, in all sizes of cable, shall have continuous solid insulation color(s) from the manufacturer. Taped ends shall not be acceptable.
 - 1. Conductors shall be color coded as follows:
 - a. 120/208 Volt Conductors
 - 1) Phase A: Black
 - 2) Phase B: Red
 - 3) Phase C: Blue
 - 4) Neutral: White
 - 5) Ground: Green
 - 6) Isolated Ground: Green/Yellow
 - 2. Fire Alarm Wiring: Red
 - 3. Signal voltage wiring color coding shall be consistent throughout the project and shall match existing equipment and standards where applicable. Color coding for each system shall be unique.
 - 4. Conductors within enclosures that may be energized when enclosure disconnect is off - yellow, or taped with 1/2" yellow tape every 6" of length, inside enclosure. Provide lamacoid plate warning sign on front of enclosure where this condition occurs.
 - 5. DC Wiring: Positive: Light Blue
Negative: Dark Blue
 - C. Identify each spare conductor at each end with identity number and location of other end of conductor, and identify as spare conductor.

END OF SECTION

DIVISION 26 – ELECTRICAL

SECTION 260526 - GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General, Special and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.
- B. The Contractor is directed to examine each and every section of these specifications, all drawings relating to the Contract Documents, any and all Addenda, etc., for work described elsewhere that may relate to the provision of the work described herein. Materials and performance requirements are specified elsewhere herein that relate to these systems.
- C. Each Electrical Contractor's attention is directed to Section 260501 - General Provisions, Electrical, and all other Contract Documents as they apply to his work.

1.2 SUMMARY

- A. Section includes grounding and bonding systems and equipment, plus the following special applications:
 - 1. Underground distribution grounding.
 - 2. Foundation steel electrodes.
 - 3. Grounding of electrical systems and equipment and basic requirements for grounding for protection of life, equipment, circuits, and systems.
 - 4. Building Ground Rings (counterpoise systems)
- B. All metallic conduit, raceways, cable trays, wireways, supports, cabinets and equipment shall be grounded in accordance with the latest National Electrical Code, as shown on the Contract Drawings and in accord with the requirements of the local authority having jurisdiction, as applicable.
- C. The size of the equipment grounding conductors, grounding electrode conductors and service grounding conductors shall be not less than that given in Article No. 250 of the National Electrical Code, and/or as shown on the Contract Drawings. Where ungrounded conductor sizes are increased to minimize voltage drop, grounded conductor sizes shall be increased in the proper proportion.
- D. Grounding bus and non-current carrying metallic parts of all equipment and raceway systems shall be securely grounded by connection to common ground.
- E. The service entrance main ground bus shall also be connected to the main cold metallic water pipe within three feet of where it enters the building, on both the house and street sides of the main shut-off valve with a properly sized bonding jumper. A properly sized bonding jumper shall also be provided to the frame of any steel structure utilized in the construction. The steel frame of the building (if any) shall be made electrically continuous.
- F. All ground electrode systems shall be installed in accordance with manufacturer's recommendations, UL listings, ANSI standards, National Electrical Code and National Electrical Safety Code.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated, including the following:
 - 1. Grounding Systems
 - 2. Ground Rods
 - 3. Ground Wires
 - 4. Connectors and Fasteners
 - 5. Bonding Materials

1.4 INFORMATIONAL SUBMITTALS

- A. As-Built Data: Plans showing dimensioned as-built locations of grounding features specified in "Field Quality Control" Article, including the following:
 - 1. Test wells.
 - 2. Ground rods.
 - 3. Ground rings.
 - 4. Grounding arrangements and connections for separately derived systems.
 - 5. Grounding for sensitive electronic equipment.
- B. Qualification Data: For testing agency and testing agency's field supervisor.
- C. Field quality-control reports. Provide the following test reports:
 - 1. Bond resistance test
 - 2. Ground resistance tests
 - 3. Ground isolation test
 - 4. Continuity isolation test

1.5 CLOSEOUT DOCUMENTS

- A. Operation and Maintenance Data: For grounding to include in emergency, operation, and maintenance manuals.
- B. In addition to items specified in Section 260501 "CLOSEOUT DOCUMENTS," include the following:
 - 1. Instructions for periodic testing and inspection of grounding features at building master ground bus and electrodes based on NFPA 70B.
 - 2. Tests shall determine if ground-resistance or impedance values remain within specified maximums, and instructions shall recommend corrective action if values do not.
 - 3. Include recommended testing intervals.

1.6 QUALITY ASSURANCE

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- B. Comply with UL 467 for grounding and bonding materials and equipment.
- C. Listing and labeling: Provide products specified in this Section that are listed and labeled.
- D. Comply with NECA's "Standard of Installation."

1.7 SYSTEM COMMISSIONING

- A. Section 019113 requires the engagement of a Commissioning Authority to document the completion of the Mechanical, Fire Protection, Plumbing, Electrical, Electronic Safety and Security, and associated Control Systems for the project. Section 019113 defines the roles and responsibilities of each member of the commissioning team.
- B. Comply with the requirements of Section 019113 for the commissioning of the various building systems.

PART 2 - PRODUCTS

2.1 SYSTEM DESCRIPTION

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- B. Comply with UL 467 for grounding and bonding materials and equipment.

2.2 MANUFACTURERS:

- A. Subject to compliance with requirements, provide products by one of the following:

1. Erico
2. ILSCO
3. Cadweld
4. Burndy
5. Therm-O-Weld
6. T&B
7. O.A. Co.
8. Lyncole XIT Grounding
9. Superior Grounding Systems
10. LEC Inc

2.3 CONDUCTORS

- A. Comply with Specification Section 260519, LOW-VOLTAGE ELECTRICAL POWER, CONDUCTORS, CABLES, SPLICING DEVICES AND CONNECTORS.
- B. Where types, sizes, ratings, and quantities indicated are in excess of National Electrical Code (NEC) requirements, the more stringent requirements and the greater size, rating, and quantity indications govern.
- C. Ground wires and cables shall be of the AWG sizes shown on the Contract Drawings or shall be sized in accordance with the prevailing codes. All ground wires and cables shall be copper.

2.4 CONNECTORS

- A. Listed and labeled by an NRTL acceptable to authorities having jurisdiction for applications in which used and for specific types, sizes, and combinations of conductors and other items connected.
- B. Bolted Connectors for Conductors and Pipes: Copper or copper alloy, pressure type with at least two bolts.
 1. Pipe connectors: Clamp type, sized for pipe.
- C. Welded Connectors: Exothermic-welding kits of types recommended by kit manufacturer for materials being joined and installation conditions.
- D. Bus-Bar Connectors: Mechanical type, cast silicon bronze, solderless compression-type wire terminals, and long-barrel, two-bolt connection to ground bus bar per EIA/TIA standards.
- E. All grounding fittings shall be heavy cast bronze or copper of the mechanical type except for underground installations or interconnection of grounding grid to cable, columns and ground electrodes, which shall be thermally welded type as manufactured by Cadweld, Burndy Co., Therm-O-Weld, or approved equivalent.

2.5 GROUND RODS

- A. Copper-clad steel; 3/4 inch in diameter by 10 feet long, molecularly bonded copper to high-strength steel core, copper thickness per UL/ANSI. Ensure ground rods are clean and smooth and have a cone-shaped point. Ensure ground rods are die-stamped near the top with the name and trademark of the manufacturer and the length in feet.

2.6 TELECOMMUNICATION CONNECTORS

- A. Irreversible connectors listed for the purpose. Listed by an NRTL as complying with NFPA 70 for specific types, sizes, and combinations of conductors and other items connected. Comply with UL 486A-486B.
- B. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 1. Chatsworth Products, Inc.
 2. Harger Lightning and Grounding.
 3. Panduit Corp.

4. Tyco Electronics Corp.
 - C. Compression Wire Connectors: Crimp-and-compress connectors that bond to the conductor when the connector is compressed around the conductor. Comply with UL 467.
 1. Electroplated tinned copper, C and H shaped.
 - D. Busbar Rack and Tray Connectors: Cast silicon bronze, solderless compression or exothermic-type, mechanical connector; with a long barrel and two holes spaced on 5/8- or 1-inch centers for a two-bolt connection to the busbar.
 - E. Welded Connectors: Exothermic-welding kits of types recommended by kit manufacturer for materials being joined and installation conditions.
 - F. Cable Tray Grounding Jumper:
 1. Not smaller than #2 AWG and not longer than 12 inches. If jumper is a wire, it shall have a crimped grounding lug with two holes and long barrel for two crimps. Attach with grounding screw or connector provided by cable tray manufacturer.
- 2.7 GROUNDING BUSBARS
- A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 1. Chatsworth Products, Inc.
 2. Harger Lightning and Grounding.
 3. Panduit Corp.
 4. Tyco Electronics Corp.
 - B. TMGB and TGB: Predrilled, wall-mounted, rectangular bars of hard-drawn solid copper in cross section and length as indicated on Drawings. The busbar shall be NRTL listed for use as TMGB and shall comply with J-STD-607-B.
 1. Connectors: Mechanical type, cast silicon bronze, solderless compression-type wire terminals, and long-barrel, two-bolt connection to ground bus bar per EIA/TIA standards.
 2. Ground Bus Bar: Copper, minimum 1/4 inch thick by 4 inches wide with four (2) rows of 9/32-inch holes spaced 1-1/8 inches apart. Minimum length of 18" or as indicated on Contract Drawings
 3. Stand-Off Insulators: Comply with UL 891 for use in switchboards, 600V. Lexan or PVC, impulse tested at 5000 V.
 4. Predrilling shall be with holes for use with lugs specified in this Section.
 5. Mounting Hardware: Stand-off brackets that provide at least a 4-inch clearance to access the rear of the busbar. Brackets and bolts shall be stainless steel.
 6. Stand-off insulators for mounting shall be Lexan or PVC. Comply with UL 891 for use in 600-V switchboards, impulse tested at 5000 V.
 - C. Comply with TIA/EIA-606-A and UL 969 for a system of labeling materials, including label stocks, laminating adhesives, and inks used by label printers.
 - D. Adhesive Film Label with Clear Protective Overlay: Machine printed, in black, by thermal transfer or equivalent process. Minimum letter height shall be 3/8 inch. Overlay shall provide a weatherproof and UV-resistant seal for label.

PART 3 - EXECUTION

3.1 GENERAL

- A. All metallic conduit, raceways, wireways, supports, cabinets and equipment shall be grounded in accordance with the latest issue of the National Electrical Code, as shown on the Contract Drawings and in accord with the requirements of the local authority having jurisdiction, as applicable.

- B. The size of the equipment shall be not less than that given in Article No. 250 of the National Electrical Code, and/or as shown on the Contract Drawings.
- C. Grounding bus and non-current carrying metallic parts of all equipment and raceway systems shall be securely grounded by connection to common ground.
- D. All outlet, junction and pull boxes shall be grounded with pigtail to the equipment grounding conductor.

3.2 APPLICATIONS

- A. Conductors: Install solid conductor for #10 AWG and smaller, and stranded conductors for #8 AWG and larger unless otherwise indicated.
- B. Underground Grounding Conductors: Install bare copper conductor, #3/0 AWG minimum or as indicated on drawings, whichever is larger.
 - 1. Bury at least 24 inches below grade.
 - 2. Duct-Bank Grounding Conductor: Bury 12 inches above duct bank when indicated as part of duct-bank installation.
- C. Isolated Grounding Conductors: Green-colored insulation with continuous yellow stripe.
- D. Grounding Bus: Install in rooms housing service equipment, and elsewhere as indicated.
 - 1. Install bus horizontally, on insulated spacers 2 inches minimum from wall, 18 inches above finished floor unless otherwise indicated.
 - 2. Where indicated on both sides of doorways, route bus up to top of door frame, across top of doorway, and down; connect to horizontal bus.
- E. Conductor Terminations and Connections:
 - 1. Pipe and Equipment Grounding Conductor Terminations: Bolted connectors.
 - 2. Underground Connections: Welded connectors except at test wells and as otherwise indicated.
 - 3. Connections to Ground Rods at Test Wells: Bolted connectors.
 - 4. Connections to Structural Steel: Welded connectors.

3.3 GROUNDING AT THE SERVICE

- A. Equipment grounding conductors and grounding electrode conductors shall be connected to the ground bus. Install a main bonding jumper between the neutral bus and ground bus.

3.4 COUNTERPOISE

- A. Provide a ground ring conductor (counterpoise) extending around the perimeter of the building. Bury counterpoise not less than 30 inches below grade and 10 feet from building foundation. Use tinned-copper conductor not less than #2/0 AWG for counterpoise and for the tap to building steel. The counterpoise conductor trench shall be filled with 1" of Erico Ground Enhancement Material (GEM) above and below the conductor. Install per Erico GEM Instruction Sheet IP7945_B.
- B. Ground the steel framework of the building with a ground rod at every corner column and at every other exterior column. The ground rods shall be located in the counterpoise trench and shall be attached to the counterpoise with a type GY (conductor-to-rod) connection by Erico and an XB (conductor-to-conductor) connection by Erico. The top of the ground rod shall not be less than 24" below grade. The conductor that attaches the rod to the counterpoise shall run continuous to the base of the structural steel column and welded to the column.

3.5 EQUIPMENT GROUNDING

- A. Install insulated equipment grounding conductors with the following items, in addition to those required by NFPA 70:
 - 1. Feeders and branch circuits.
 - 2. Lighting circuits.

3. Receptacle circuits.
 4. Single-phase motor and appliance branch circuits.
 5. Three-phase motor and appliance branch circuits.
 6. Flexible raceway runs.
 7. Busway Supply Circuits
 8. Computer and Rack-Mounted Electronic Equipment Circuits.
- B. Busway Supply Circuits: Install insulated equipment grounding conductor from grounding bus in the switchgear, switchboard, or distribution panel to equipment grounding bar terminal on busway.
- C. Air-Duct Equipment Circuits: Install insulated equipment grounding conductor to duct-mounted electrical devices operating at 120 V and more, including air cleaners, heaters, dampers, humidifiers, and other duct electrical equipment. Bond conductor to each unit and to air duct and connected metallic piping.
- D. Isolated Grounding Receptacle Circuits: Install an insulated equipment grounding conductor connected to the receptacle grounding terminal. Isolate conductor from raceway and from panelboard grounding terminals. Terminate at equipment grounding conductor terminal of the applicable derived system or service unless otherwise indicated.
- E. Isolated Equipment Enclosure Circuits: For designated equipment supplied by a branch circuit or feeder, isolate equipment enclosure from supply circuit raceway with a nonmetallic raceway fitting listed for the purpose. Install fitting where raceway enters enclosure, and install a separate insulated equipment grounding conductor. Isolate conductor from raceway and from panelboard grounding terminals. Terminate at equipment grounding conductor terminal of the applicable derived system or service unless otherwise indicated.
- F. Signal and Communication Equipment: In addition to grounding and bonding required by NFPA 70, provide a separate grounding system complying with requirements in TIA/ATIS J-STD-607-A.
1. For telephone, alarm, voice and data, and other communication equipment, provide #4/0 minimum insulated grounding conductor in raceway from grounding electrode system to each service location, terminal cabinet, wiring closet, and central equipment location.
 2. Service and Central Equipment Locations and Wiring Closets: Terminate grounding conductor on a 1/4-by-4-by-18-inch grounding bus.
 3. Terminal Cabinets: Terminate grounding conductor on cabinet grounding terminal.

3.6 INSTALLATION

- A. Grounding Conductors: Route along shortest and straightest paths possible unless otherwise indicated or required by Code. Avoid obstructing access or placing conductors where they may be subjected to strain, impact, or damage.
- B. All grounding conductors shall be protected from mechanical injury and shall be rigidly supported. Where ground conductors are run through flexible conduit and through panelboard switchboard or motor control center feeders, they shall be securely bonded to such conduit thru the use of grounding bushings at the entrance and exit. All connection of equipment shall be made with an approved type of solderless connection and same shall be bolted or clamped to equipment or conduit.
- C. Equipment ground connections to GFI circuit breakers shall be carried and bonded to each outlet on the circuit. Provide a separate equipment grounding conductor with green color insulation.
- D. Equipment grounding conductors shall be routed to lighting fixtures, devices, receptacles, electric heaters, furnace and other equipment. Equipment grounding conductors shall be green.
- E. Resistance to the grounding at the service entrance equipment shall be in accordance with the NEC for style of construction and shall not exceed five ohms as measured by the described testing method.
- F. All circuits shall have a grounding conductor.
- G. When grounding systems are completely installed and all grading in the area of the service grounding electrode has been completed up to finish elevations, perform a fall-of potential or other approved test to

determine actual system resistance to earth. Report results to the Engineer in writing. Refer to testing provisions in this section of specifications.

- H. Where separately-derived systems are utilized as part of the power distribution network, the neutral leg of the secondary side of transformers, etc., shall be connected to a grounding electrode in accordance with the manufacturer's recommendations.
- I. The Contractor shall ensure that the ground return path thru building structural steel or other means is electrically continuous back to the service grounding electrode and is of adequate capacity and impedance to carry the maximum expected fault or other current. Where no electrically continuous steel building frame is available, the Contractor shall provide a properly sized ground bar and ground conductor routed back to the main facility ground bus.
- J. Where a building's steel frame is made electrically discontinuous by masonry breaks (as at firewalls, etc.), the Contractor shall provide an accessible thermally welded bonding jumper of #500Kcmil copper to bond the building steel frame sections together, making the entire steel frame electrically continuous. The installation of these bonding jumpers shall be reviewed by the Engineer prior to their being covered by construction.
- K. Grounding connections shall never be made to fire protection, natural gas, flammable gas or liquid fuel piping, except where specifically indicated on the plans.
- L. Where dielectric fittings are utilized in piping systems, the piping system shall not be utilized as a ground path. Bonding jumpers shall not be utilized to bridge over such fittings. Piping systems shall not be utilized as ground paths except where specifically required by codes in the case of water piping.
- M. Ground Bonding Common with Lightning Protection System: Comply with NFPA 780 and UL 96 when interconnecting with lightning protection system. Bond electrical power system ground directly to lightning protection system grounding conductor at closest point to electrical service grounding electrode. Use bonding conductor sized same as system grounding electrode conductor, and install in conduit.
- N. At all metallic outlet, junction and pull boxes, bond the equipment grounding conductor to the box.
- O. Ground Rods: Drive rods until tops are 12 inches below finished floor or final grade unless otherwise indicated.
 - 1. Interconnect ground rods with grounding electrode conductor below grade and as otherwise indicated. Make connections without exposing steel or damaging coating if any.
 - 2. For grounding electrode system, install at least three rods spaced at least one-rod length from each other and located at least the same distance from other grounding electrodes, and connect to the service grounding electrode conductor.
 - 3. Provide well access for testing at one (1) rod.
- P. Test Wells: Ground rod driven through drilled hole in bottom of handhole. Handholes are specified in Division 26 Section "Underground Ducts and Raceways for Electrical Systems," and shall be at least 12 inches (300 mm) deep, with cover.
 - 1. Test Wells: Install at least one test well for each service unless otherwise indicated. Install at the ground rod electrically closest to service entrance. Set top of test well flush with finished grade or floor.
- Q. Bonding Straps and Jumpers: Install in locations accessible for inspection and maintenance except where routed through short lengths of conduit.
 - 1. Bonding to Structure: Bond straps directly to basic structure, taking care not to penetrate any adjacent parts.
 - 2. Bonding to Equipment Mounted on Vibration Isolation Hangers and Supports: Install bonding so vibration is not transmitted to rigidly mounted equipment.
 - 3. Use exothermic-welded connectors for outdoor locations; if a disconnect-type connection is required, use a bolted clamp.

- R. Grounding and Bonding for Piping:
1. Metal Water Service Pipe: Install insulated copper grounding conductors, in conduit, from building's main service equipment, or grounding bus, to main metal water service entrances to building. Connect grounding conductors to main metal water service pipes; use a bolted clamp connector or bolt a lug-type connector to a pipe flange by using one of the lug bolts of the flange. Where a dielectric main water fitting is installed, connect grounding conductor on street side of fitting. Bond metal grounding conductor conduit or sleeve to conductor at each end.
 2. Water Meter Piping: Use braided-type bonding jumpers to electrically bypass water meters. Connect to pipe with a bolted connector.
 3. Bond each aboveground portion of gas piping system downstream from equipment shutoff valve.
- S. Bonding Interior Metal Ducts: Bond metal air ducts to equipment grounding conductors of associated fans, blowers, electric heaters, and air cleaners. Install tinned bonding jumper to bond across flexible duct connections to achieve continuity.
- T. Grounding for Steel Building Structure: Provide a driven ground rod at base of each corner column and at intermediate exterior columns at distances not more than 60 feet apart.
- U. Concrete-Encased Grounding Electrode (Ufer Ground): Provide and fabricate according to NFPA 70; use a minimum of 20 feet of bare copper conductor not smaller than #4 AWG.
1. If concrete foundation is less than 20 feet long, coil excess conductor within base of foundation.
 2. Bond grounding conductor to reinforcing steel in at least four locations and to anchor bolts. Extend grounding conductor below grade and connect to building's grounding grid or to grounding electrode external to concrete.
- V. Perform ground testing, log results, and provide reports of test points, test values, and procedure as required by engineer and/or local authority having jurisdiction. All systems shall be grounded to maintain leakage current below levels required by applicable codes and standards.
- W. Grounding Busbars:
1. Install busbars horizontally, on insulated spacers 4 inches minimum from wall, 72 inches above finished floor unless otherwise indicated.
 2. Where indicated on both sides of doorways, route bus up to top of door frame, across top of doorway, and down; connect to horizontal bus.
- 3.7 TELECOMMUNICATIONS CONNECTIONS: Electrical Contractor shall perform the following work whether equipment and devices are provided by the Owner, Owner's Vendor or by the Electrical Contractor:
- A. Bond metallic equipment in a telecommunications equipment room to the grounding busbar in that room, using equipment grounding conductors not smaller than #6 AWG.
 - B. Stacking of conductors under a single bolt is not permitted when connecting to busbars.
 - C. Primary Protector: Bond to the TMGB with insulated bonding conductor.
 - D. Interconnections: Interconnect all TGBs with the TMGB with the telecommunications backbone conductor. If more than one TMGB is installed, interconnect TMGBs using the grounding equalizer conductor shall be as indicated on the drawings.
 - E. Telecommunications Enclosures and Equipment Racks: electrical Contractor shall bond metallic components of enclosures to the telecommunications bonding and grounding system. Install top-mounted rack grounding busbar. Bond the equipment grounding busbar to the TGB with #2 AWG bonding conductors.
 - F. Shielded Cable: Bond the shield of shielded cable to the TGB in communications rooms and spaces. Comply with TIA/EIA-568-C.1 and TIA/EIA-568-C.2 when grounding screened, balanced, twisted-pair cables.

G. Rack- and Cabinet-Mounted Equipment:

H. Bond powered equipment chassis to the cabinet or rack grounding bar. Power connection shall comply with NFPA 70; the equipment grounding conductor in the power cord of cord- and plug-connected equipment shall be considered as a supplement to bonding requirements in this Section.

1. Waveguides and Coaxial Cable:

- a. Bond cable shields at the point of entry into the building to the TGB and to the cable entrance plate, using No. 2 AWG bonding conductors.
- b. Bond coaxial cable surge arrester to the ground or roof ring using bonding conductor size recommended by surge-arrester manufacturer.

3.8 FIELD QUALITY CONTROL

A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.

B. Tests and Inspections:

1. After installing grounding system but before permanent electrical circuits have been energized, test for compliance with requirements.
2. Inspect physical and mechanical condition. Verify tightness of accessible, bolted, electrical connections with a calibrated torque wrench according to manufacturer's written instructions.
3. Test completed grounding system at each location where a maximum ground-resistance level is specified, at service disconnect enclosure grounding terminal, at ground test wells and at individual ground rods. Make tests at ground rods before any conductors are connected.
 - a. Measure ground resistance no fewer than two full days after last trace of precipitation and without soil being moistened by any means other than natural drainage or seepage and without chemical treatment or other artificial means of reducing natural ground resistance.
 - b. Perform tests by four point fall-of-potential method according to IEEE 81.
4. Prepare dimensioned Drawings locating each test well, ground rod and ground-rod assembly, and other grounding electrodes. Identify each by letter in alphabetical order, and key to the record of tests and observations. Include the number of rods driven and their depth at each location, and include observations of weather and other phenomena that may affect test results. Describe measures taken to improve test results.

C. Grounding system will be considered defective if it does not pass tests and inspections.

D. Prepare test and inspection reports.

E. Report measured ground resistances:

1. Power and Lighting Equipment or System with Capacity of 500 kVA and Less: 10 ohms.
2. Power and Lighting Equipment or System with Capacity of 500 to 1000 kVA: 5 ohms.
3. Power and Lighting Equipment or System with Capacity More Than 1000 kVA: 3 ohms.
4. Power Distribution Units or Panelboards Serving Electronic Equipment: 1 ohm.
5. Substations and Pad-Mounted Equipment shall be 5 ohms or less.

F. Excessive Ground Resistance: If resistance to ground exceeds specified values, notify Architect promptly and include recommendations to reduce ground resistance.

3.9 SERVICE GROUND TESTING PROCEDURE

A. The actual resistance to earth of the service grounding electrode shall be measured by the Contractor via the fall-of-potential method. This testing shall be accomplished after the grounding electrode has been completely installed and the finished grade is achieved.

B. The results of the testing shall be summarized in a written report by the Contractor, which shall be forwarded to the Engineer for review. The report shall also be included with the operation and maintenance manuals for the Owner's information and future reference. This report is to also contain a

detailed description and illustrations of the testing procedure, along with the name and model number of the testing instrument(s).

- C. For the actual testing, the Contractor shall follow the procedures outlined below. A self-contained instrument such as a "Megger" or "Ground OHMMETER" shall be used that is designed to eliminate the influence of stray current effects on the accuracy of the measurements.
 - D. Connect one side of the instrument to the grounding electrode conductor where it connects to the facility main ground bus (point C1). Disconnect and isolate the grounding electrode conductor for the test.
 - E. Drive a copperweld reference electrode probe (point C2) into earth between 300 and 500 feet away from C1 and connect to measurement instrument.
 - F. Drive the movable grounding probe (C3) into earth at ten equally spaced intervals, in a straight line between C1 and C2 points and note the $E/I=R$ resistance readings on a graph at each point.
 - G. The resistance measurements in OHMS taken from the flat part of the curve shall be averaged to determine the true grounding electrode resistance to earth.
 - H. At completion of testing, remove reference electrode C2 and all temporary wiring and connections.
 - I. If actual measurements of grounding electrode indicate a resistance greater than five OHMS, contact the Engineer for instructions. If deemed necessary by the Engineer, additional electrodes shall be placed and the measurement process repeated until the desired ground potential is achieved.
 - J. Record results for each step in the testing process and include a full report in close-out documentation.
- 3.10 FUNCTIONAL PERFORMANCE TESTS
- A. System functional performance testing is part of the Commissioning Process as specified in Section 019113. Functional performance testing shall be performed by the contractor and witnessed and documented by the Commissioning Authority.

END OF SECTION

DIVISION 26 – ELECTRICAL

SECTION 260529 - HANGERS AND SUPPORTS FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General, Special and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.
- B. The Contractor is directed to examine each and every section of these specifications, all drawings relating to the Contract Documents, any and all Addenda, etc., for work described elsewhere that may relate to the provision of the work described herein. Materials and performance requirements are specified elsewhere herein that relate to these systems.
- C. Each Electrical Contractor's attention is directed to Section 260501 - General Provisions, Electrical, and all other Contract Documents as they apply to his work.

1.2 SUMMARY

- A. Section Includes the following:
 - 1. Hangers and supports for electrical equipment and systems.
 - 2. Construction requirements for concrete bases.
 - 3. Isolation pads.
- B. Related Sections include the following:
 - 1. Division 26 Section "Vibration Controls for Electrical Systems" for products and installation requirements necessary for compliance with seismic criteria.

1.3 DEFINITIONS

- A. EMT: Electrical metallic tubing.
- B. FMC: Flexible metal conduit
- C. LFMC: Liquid-tight flexible metal conduit
- D. GRS: Galvanized rigid steel conduit.

1.4 PERFORMANCE REQUIREMENTS

- A. Delegated Design: Design supports for multiple raceways, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.
- B. Design supports for multiple raceways capable of supporting combined weight of supported systems and its contents.
- C. Design equipment supports capable of supporting combined operating weight of supported equipment and connected systems and components.
- D. Rated Strength: Adequate in tension, shear, and pullout force to resist maximum loads calculated or imposed for this project, with a minimum structural safety factor of five times the applied force.

1.5 SUBMITTALS

- A. Product Data: For the following:
 - 1. Steel slotted support systems.
 - 2. Nonmetallic slotted support systems.
- B. Shop Drawings: Signed and sealed by a qualified professional engineer. Show fabrication and installation details and include calculations for the following:

1. Trapeze hangers. Include Product Data for components.
2. Steel slotted channel systems. Include Product Data for components.
3. Nonmetallic slotted channel systems. Include Product Data for components.
4. Equipment supports.
5. Concrete Based for Equipment.
6. Vibration Isolation Base Details: Detail fabrication, including anchorages and attachments to structure and to supported equipment. Include adjustable motor bases, rails, and frames for equipment mounting.
7. Delegated-Design Submittal: For hangers and supports for electrical systems.
8. Include design calculations and details of trapeze hangers.

1.6 QUALITY ASSURANCE

- A. Welding: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."
- B. Comply with NFPA 70.

1.7 COORDINATION

- A. Coordinate size and location of concrete bases. Cast anchor-bolt inserts into bases. Concrete, reinforcement, and formwork requirements are specified in Division 03.
- B. Coordinate installation of roof curbs, equipment supports, and roof penetrations. These items are specified in Division 07 Section "Roof Accessories."

PART 2 - PRODUCTS

2.1 SUPPORT, ANCHORAGE, AND ATTACHMENT COMPONENTS

- A. Steel Slotted Support Systems: Comply with MFMA-4, factory-fabricated components for field assembly.
 1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Allied Tube & Conduit
 - b. Cooper B-Line, Inc.; a division of Cooper Industries.
 - c. ERICO International Corporation.
 - d. Thomas & Betts Corporation.
 - e. Unistrut; Tyco International, Ltd.
 2. Metallic Coatings: Hot-dip galvanized after fabrication and applied according to MFMA-4.
 3. Channel Dimensions: Selected for applicable load criteria.
- B. Raceway and Cable Supports: As described in NECA 1 and NECA 101.
- C. Conduit and Cable Support Devices: Steel and malleable hangers, clamps, and associated fittings, designed for types and sizes of raceway or cable to be supported.
- D. Support for Conductors in Vertical Conduit: Factory-fabricated assembly consisting of threaded body and insulating wedging plug or plugs for non-armored electrical conductors or cables in riser conduits. Plugs shall have number, size, and shape of conductor gripping pieces as required to suit individual conductors or cables supported. Body shall be malleable iron.
- E. Device Box Mounting Brackets: Factory-fabricated sheet steel brackets for support of device boxes adjacent to or between studs.
 1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Cooper B-Line, Inc.; a division of Cooper Industries.
 - b. ERICO International Corporation.

- F. Through-Stud Cable and Raceway Support Clips: Factory-fabricated spring steel clip for cables or raceways where run horizontally through metal studs.
 - 1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Cooper B-Line, Inc.; a division of Cooper Industries.
 - b. ERICO International Corporation.
- G. Roof-mounted Raceway Support Blocking: Factory-fabricated support blocking for use under roof-mounted raceways. Wedge-shaped blocking constructed of 100% recycled UV-resistant Rubber with integral galvanized steel strut to accept raceway support clips.
 - 1. Basis-of-Design Product: Subject to compliance with requirements, provide Cooper B-Line C-Port series components or a comparable product by one of the following:
 - a. Cooper B-Line, Inc.; a division of Cooper Industries.
 - b. ERICO International Corporation.
- H. Tee Bar Grid Box Hanger: Factory-fabricated metal electrical box hanger for supporting boxes at locations between ceiling system t-grid components. Height adjustable for various electrical box depths. Attached to ceiling tee bar with screws or integral clamp for stability. Includes tab for independent support wire attachment.
 - 1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Cooper B-Line, Inc.; a division of Cooper Industries.
 - b. ERICO International Corporation.
- I. Structural Steel for Fabricated Supports and Restraints: ASTM A 36/A 36M, steel plates, shapes, and bars; black and galvanized.
- J. Mounting, Anchoring, and Attachment Components: Items for fastening electrical items or their supports to building surfaces include the following:
 - 1. Mechanical-Expansion Anchors: Insert-wedge-type, zinc-coated or stainless steel, for use in hardened Portland cement concrete with tension, shear, and pullout capacities appropriate for supported loads and building materials in which used.
 - a. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - 1) Cooper B-Line, Inc.; a division of Cooper Industries.
 - 2) Empire Tool and Manufacturing Co., Inc.
 - 3) Hilti Inc.
 - 4) ITW Ramset/Red Head; a division of Illinois Tool Works, Inc.
 - 5) MKT Fastening, LLC.
 - 2. Concrete Inserts: Steel or malleable-iron, slotted support system units similar to MSS Type 18; complying with MFMA-4 or MSS SP-58.
 - 3. Clamps for Attachment to Steel Structural Elements: MSS SP-58, type suitable for attached structural element.
 - 4. Through Bolts: Structural type, hex head, and high strength. Comply with ASTM A 325.
 - 5. Toggle Bolts: All-steel springhead type.
 - 6. Hanger Rods: Solid, threaded steel.

2.2 FABRICATED METAL EQUIPMENT SUPPORT ASSEMBLIES

- A. Description: Welded or bolted, structural-steel shapes, shop or field fabricated to fit dimensions of supported equipment.

- B. Materials: Comply with requirements in Division 05 Section "Metal Fabrications" for steel shapes and plates.

2.3 VIBRATION ISOLATION PADS

- A. Basis-of-Design Product: Subject to compliance with requirements, provide Korfund Maxi-Flex Pads or a comparable product by one of the following:
 - 1. Ace Mountings Co., Inc.
 - 2. Amber/Booth Company, Inc.
 - 3. California Dynamics Corporation.
 - 4. Isolation Technology, Inc.
 - 5. Kinetics Noise Control.
 - 6. Mason Industries.
 - 7. Vibration Eliminator Co., Inc.
 - 8. Vibration Isolation.
 - 9. Vibration Mountings & Controls, Inc.
- B. Pads: Arrange in single or multiple layers of sufficient stiffness for uniform loading over pad area, molded with a nonslip pattern, and factory cut to sizes that match requirements of supported equipment.
 - 1. Resilient Material: Oil- and water-resistant neoprene.

PART 3 - EXECUTION

3.1 APPLICATION

- A. Comply with NFPA 70, NECA 1 and NECA 101 for application of hangers and supports for electrical equipment and systems except where requirements of this Section are more stringent.
- B. Maximum Horizontal and Vertical Support Spacing for Raceway(s): Space supports for EMT and GRS as required by NFPA 70.
- C. Minimum Hanger Rod Size for Raceway Supports: Minimum rod size shall be 1/4 inch in diameter.
- D. Single Raceways:
 - 1. For Raceways 1-1/4-inch and smaller: Install adjustable steel band hanger suspended on threaded rod.
 - 2. For Raceways larger than 1-1/4-inch: Install trapeze-type supports fabricated with steel slotted support system suspended on threaded rods. Size trapeze members, including the suspension rods, based on the support required for the size, and loaded weight of the conduits.
 - a. Secure raceway or cable to support with two-bolt conduit clamps or single-bolt conduit clamps using spring friction action for retention in support channel.
- E. Multiple Raceways: Install trapeze-type supports fabricated with steel slotted support system suspended on threaded rods, where multiple raceways are run vertically or horizontally at the same elevations. Size trapeze members, including the suspension rods, based on the support required for the number, size, and loaded weight of the conduits. Space them as required for the smallest conduit to be supported. Size so capacity can be increased by at least 25 percent in future without exceeding specified design load limits.
 - 1. Secure raceways and cables to these supports with two-bolt conduit clamps or single-bolt conduit clamps using spring friction action for retention in support channel.
- F. Spring-steel clamps designed for supporting single conduits without bolts may be used for 1-1/2-inch and smaller raceways serving branch circuits and communication systems above suspended ceilings and for fastening raceways to trapeze supports.

3.2 EXAMINATION

- A. Examine areas and equipment to receive vibration isolation devices for compliance with requirements for installation tolerances and other conditions affecting performance.
- B. Examine roughing-in of reinforcement and cast-in-place anchors to verify actual locations before installation.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.3 SUPPORT INSTALLATION

- A. Comply with NFPA 70, NECA 1 and NECA 101 for installation requirements except where requirements of this Article are more stringent.
- B. Fasten junction, pull and devices boxes securely to the building construction, independent of raceway system.
- C. Install Device Box Mounting Brackets supported between two studs. All device boxes shall attached to two studs, device box stabilizers shall not be acceptable.
- D. Install Through-Stud Cable and Raceway Support Clips where cables or raceways run horizontally through metal studs.
- E. Install Tee Bar Grid Box Hanger supported between two ceiling grid tee bars where devices boxes are located flush in recessed suspended ceilings.
 - 1. Install at least one independent support rod from box hanger to structure.
- F. Install Roof-mounted Raceway Support Blocking where raceways run on across roofing.
 - 1. Coordinate installation of roof supports with items specified in Division 07 Section "Roof Accessories." Provide products compatible with rooftop materials included in the Work.
- G. Provide minimum of two lock nuts per threaded support rod except where lock nut tightens against a threaded socket, one locknut may be used.
- H. Support raceways at a distance above suspended ceilings to permit removal of ceiling panels and luminaires.
- I. Locate raceways so as not to hinder access to mechanical equipment.
- J. Do not secure conductors, raceways, or supports to suspended ceiling hanger rods or wires.
- K. Strength of Support Assemblies: Where not indicated, select sizes of components so strength will be adequate to carry present and future static loads within specified loading limits. Minimum static design load used for strength determination shall be weight of supported components plus 200 lb (90 kg).
- L. Mounting and Anchorage of Surface-Mounted or Recessed-Mounted Equipment and Components: Anchor and fasten electrical items and their supports to building structural elements by the following methods unless otherwise indicated by code:
 - 1. To Wood: Fasten with lag screws or through bolts.
 - 2. To New Concrete: Bolt to concrete inserts. Where support anchors are required, establish their type and locate in concrete construction before concrete is poured, if possible. Fit each hanger rod with a nut at its upper end, and set nut in a universal concrete insert in the form. Where supported weight exceeds holding strength of a single insert, pass rods through top slot of inserts and interlock with reinforcing steel. Also, where particularly heavy loads are to be supported, suspend hanger rod or rods from a structural angle spanning two or more inserts and securely bolted thereto to distribute the weight.
 - 3. To Masonry: Approved toggle-type bolts on hollow masonry units and expansion anchor fasteners on solid masonry units.
 - 4. To Existing Concrete: Expansion anchor fasteners.
 - 5. To Steel: Beam clamps (MSS Type 19, 21, 23, 25, or 27) complying with MSS SP-69 or Spring-tension clamps.

6. To Light Steel: Sheet metal screws.
 7. For Surface-Mounted Items on Hollow Walls and Nonstructural Building Surfaces: Mount cabinets, panelboards, disconnect switches, control enclosures, pull and junction boxes, transformers, and other devices on slotted-channel racks attached to structure by means that meet seismic-restraint strength and anchorage requirements. Attachment to gypsum wall board is not acceptable as sole support means; slotted-channel rack solidly attached to structure or light-gauge metal framing at both ends is required.
 8. For Recessed-Mounted Items in Hollow Walls and Nonstructural Building Surfaces: Mount cabinets, panelboards, disconnect switches, control enclosures, pull and junction boxes, transformers, and other devices to intermediate light-gauge metal framing members on each side of device or provide slotted-channel racks within hollow wall attached to structure by means that meet seismic-restraint strength and anchorage requirements. Attachment to gypsum wall board is not acceptable as sole support means.
- M. Do not support any items (equipment, piping, conduit, etc.) exceeding 2 inches in diameter from the bottom of slabs. Where intermediate supports are required between structural members, use slotted steel channels support systems attached to beams or joists in order to avoid attachment to slabs.
- N. Drill holes for expansion anchors in concrete at locations and to depths that avoid reinforcing bars. Verify reinforcing locations with Structural Engineer. X-Ray existing concrete structures as required.
- 3.4 INSTALLATION OF FABRICATED METAL SUPPORTS
- A. Comply with installation requirements in Division 05 Section "Metal Fabrications" for site-fabricated metal supports.
 - B. Cut, fit, and place miscellaneous metal supports accurately in location, alignment, and elevation to support and anchor electrical materials and equipment.
 - C. Field Welding: Comply with AWS D1.1/D1.1M.
- 3.5 CONCRETE BASES
- A. Construct concrete bases of dimensions indicated but not less than 3 inches larger in all directions than supported unit, and so anchors will be a minimum of 10 bolt diameters from edge of the base.
 - B. Use 3000-psi, 28-day compressive-strength concrete. Concrete materials, reinforcement, and placement requirements are specified in Division 03 Section "Cast-in-Place Concrete."
 - C. Anchor equipment to concrete base.
 1. Place and secure anchorage devices. Use supported equipment manufacturer's setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
 2. Install anchor bolts to elevations required for proper attachment to supported equipment.
 3. Install anchor bolts according to anchor-bolt manufacturer's written instructions.
- 3.6 PAINTING
- A. Touchup: Comply with requirements in Division 09 painting Sections for cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint on miscellaneous metal.
 - B. Galvanized Surfaces: Clean welds, bolted connections, and abraded areas and apply galvanizing-repair paint to comply with ASTM A 780.

END OF SECTION

DIVISION 26 – ELECTRICAL

SECTION 260533 - RACEWAYS AND FITTINGS FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General, Special and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.
- B. The Contractor is directed to examine each and every section of these specifications, all drawings relating to the Contract Documents, any and all Addenda, etc., for work described elsewhere that may relate to the provision of the work described herein. Materials and performance requirements are specified elsewhere herein that relate to these systems.
- C. Each Electrical Contractor's attention is directed to Section 260501 - General Provisions, Electrical, and all other Contract Documents as they apply to his work.

1.2 SUMMARY

- A. This section is intended to specify the raceways, conduit, conduit fittings, hangers, junction boxes, splice boxes, specialties and related items necessary to complete the work as shown on the drawings and specified herein.
- B. This section specifies basic materials and methods and is a part of each Division 26, 27 and 28 Sections that implies or refers to electrical raceways specified therein.
- C. The types of raceways specified in this section include the following:
 - 1. Steel electrical metallic tubing (EMT)
 - 2. Galvanized rigid steel conduit (GRS or RMC)
 - 3. Intermediate metal conduit (IMC)
 - 4. Rigid aluminum conduit (RAC)
 - 5. Flexible metal conduit (FMC)
 - 6. Liquid-tight flexible metal conduit (LFMC)
 - 7. Rigid nonmetallic conduit (RNC)
 - 8. Surface metal raceway (SMR)
 - 9. Metal wireways and auxiliary gutters.
 - 10. Wall ducts and trench ducts.
 - 11. Cable tray or cable trough.
 - 12. Duct banks, and their construction.
- D. All raceways, as listed above and otherwise specified herein shall be provided in compliance with latest editions of all applicable UL, NEMA, NEC and ANSI standards. All conduit, raceways and fittings shall be Underwriters Laboratories listed and labeled, or bear the listing of an agency acceptable to the local authority having jurisdiction.
- E. Conduit and raceways, as well as supporting inserts in contact with or enclosed in concrete shall comply with the latest edition of all ACI standards and the equipment manufacturer's recommendations for such work.
- F. The decision of the Engineer shall be final and binding in any case where a question or inquiry arises regarding the suitability of a particular installation or application of raceways, supports or materials, if other than outlined herein.
- G. Minimum size of conduit shall be 3/4" trade size for power and 1-1/4" trade size for voice/data/TV unless otherwise noted on the drawings. All conduit and raceways shall be sized for the number of conductors contained, in accord with the latest edition of the National Electrical Code or any other applicable standards.

- H. The installer of raceway systems shall avoid the use of dissimilar metals within raceway installations that would result in galvanic-action corrosion.
- I. PVC or other non-metallic conduit shall be rated for the maximum operating temperature that could be developed by the conductors it encloses, while in normal operation.
- J. Fire Alarm Cabling (open): All wiring which is exposed, concealed in walls, concealed above inaccessible ceilings, or otherwise inaccessible shall be installed within conduit and enclosed junction boxes. Provide a completely separate conduit system from power wiring or other raceway systems. All concealed conduit shall be manufactured red – no field painting will be accepted – and exposed conduit in finished spaces shall be painted to match adjacent finishes. Concealed cabling above accessible ceilings shall be an open cabling system ran in dedicated 2” J-hooks. Provide J-hooks above or below primary cabling paths used for other systems. Conduit stub-outs shall be run to these paths. Cabling shall be listed by the fire alarm system manufacturer for use with their system. Cabling shall be air-plenum-rated.

1.3 QUALITY ASSURANCE

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
- B. Comply with NFPA 70.

1.4 ACTION SUBMITTALS

- A. Product Data: Submit manufacturer's product data for raceways, conduits, outlet boxes, and wireways.
- B. Shop Drawings:
 - 1. Submit Shop Drawings of the complete metal surface raceway system.
 - 2. Shop Drawings shall include sizes and lengths of raceways, inside corners, outside corners, end caps, raceway cover spacing, grounding, branch circuiting and wiring including locations of service entrances, receptacle types and manufacturers, receptacle spacing, and receptacle labeling with proper voltage, phase, circuit and panelboard designations as indicated on the Drawings.

1.5 INFORMATIONAL SUBMITTALS

- A. Coordination Drawings: Conduit routing plans, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of items involved:
 - 1. Structural members in paths of conduit groups with common supports.
 - 2. HVAC and plumbing items and architectural features in paths of conduit groups with common supports.
- B. Qualification Data: For professional engineer.

PART 2 - PRODUCTS

2.1 METAL CONDUITS AND FITTINGS

- A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - 1. AFC Cable Systems, Inc.
 - 2. Allied Tube & Conduit; a Tyco International Ltd. Co.
 - 3. Anamet Electrical, Inc.
 - 4. Electri-Flex Company.
 - 5. O-Z/Gedney; a brand of EGS Electrical Group.
 - 6. Picoma Industries, a subsidiary of Mueller Water Products, Inc.
 - 7. Republic Conduit.
 - 8. Robroy Industries.

9. Southwire Company.
 10. Thomas & Betts Corporation.
 11. Western Tube and Conduit Corporation.
 12. Wheatland Tube Company; a division of John Maneely Company.
- B. Listing and Labeling: Metal conduits, tubing, and fittings shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- C. STEEL ELECTRICAL METALLIC TUBING
1. Electrical metallic tubing (EMT), of corrosion-resistant zinc coated cold rolled steel tubing shall be permitted for concealed installation in dry interior locations.
 2. EMT shall not be installed underground, in concrete slabs or where exposed to physical damage. EMT shall be permitted for exposed work in mechanical and electrical rooms and other exposed structure areas where not subjected to physical damage, as determined by the Engineer. All exposed conduit and fittings located within 8'-0" of finished floor shall be rigid steel with threaded connectors.
 3. Comply with ANSI C80.3 and UL 797.
 4. Connectors and couplings for EMT: Concrete- or rain-tight, compression type, made of zinc- or chromium-plated steel. Connectors shall have nylon insulating throats.
- D. GALVANIZED RIGID STEEL CONDUIT
1. Galvanized rigid steel conduit (GRS or RMC) shall have a zinc coating inside and outside by means of hot-dip galvanizing. Use only threaded fittings for GRS.
 2. Use GRS where subject to physical damage for exposed work in mechanical spaces, within factory or other industrial work areas, for exposed fit-up work on machinery, for exposed exterior damp or wet location work, in hazardous atmospheres, in exterior underground locations where installed beneath roadways, where ells occur in underground PVC conduits, or where turning out of concrete encased duct banks, and at other locations as specifically called out on the drawings.
 3. GRS shall be used for all building interior power wiring or cables of over 600 Volts.
 4. GRS shall be delivered with plastic protectors on the threads.
 5. GRS threads shall not have any coating which will reduce conductivity of the joint.
 6. Couplings, bends, elbows and fittings shall be subject to the same requirements as for the straight lengths.
 7. Comply with ANSI C80.1 and UL 6.
 8. "Kwik-Couple" type fittings are not acceptable.
 9. Use polyvinylchloride (PVC) coated rigid steel conduit in accordance with NEMA RN 1, Type 40 (40 mils thick) where underground and in corrosive areas.
- E. INTERMEDIATE METAL CONDUIT
1. Unless otherwise indicated on the drawings, intermediate metal conduit (IMC) may be used in any location in place of rigid galvanized steel conduit, as permitted by codes, and as approved by the Engineer.
 2. Manufactured in conformance with UL standards.
 3. Comply with ANSI C80.6 and UL 1242.
- F. RIGID ALUMINUM CONDUIT
1. Rigid aluminum conduit shall be permitted for installation indoors in dry locations only. Under no conditions shall it be cast into concrete slabs or pass thru construction where prolonged contact will degrade the aluminum.
 2. All ells used in rigid aluminum conduit systems shall be rigid galvanized steel.
 3. Manufactured in conformance with UL standards.
 4. Comply with ANSI C80.5 and UL 6A.
- G. FLEXIBLE METAL CONDUIT

1. Flexible metal conduit may be used only where required for connection to light fixtures, motors and other equipment subject to vibration. It shall be constructed of galvanized steel. It shall be installed with connectors designed for the purpose. All flexible metal conduit shall be installed as a single piece. No joints shall be installed. Flexible conduit shall not be used in wet or dusty locations or where exposed to oil, water or other damaging environments. An equipment grounding conductor or bonding jumper shall be used at all flexible conduit installations. Flexible metal conduit shall not be used in lengths over six feet for light fixture and three feet for other connections. Flexible metal conduit shall not be used in telephone, fire alarm, intercom, security, and other communication systems.
2. Comply with UL 1.

H. LIQUIDTIGHT FLEXIBLE METAL CONDUIT

1. Weatherproof flexible metal conduit shall be wound from a single strip of steel, neoprene covered, equivalent to "Liquatite" or "Sealtite" Type "UA". It shall be installed in such a manner that it will not tend to pull away from the connectors. Provide strain relief fittings equivalent to "Kellems" as required where subject to vibration. Flexible connections to motors in dusty areas shall be dust-tight, in areas exposed to the weather - weatherproof. Length shall not exceed 3' unless permitted by the Engineer.
2. Comply with UL 360.
3. Liquidtight type connectors: UL 14814A. Fittings: With nylon insulated throat.

I. RIGID NON-METALLIC CONDUIT

1. Polyvinylchloride (PVC) Conduit:
 - a. PVC conduit shall be Type II, in conformance with NEMA TC2 and the following:
 - 1) Schedule 40 and 80, high impact.
 - 2) Suitable for use with 90°C rated wire.
 - 3) Conform to UL Standard 651 and carry appropriate UL listing for above and below ground use.
2. Rigid non-metallic conduit shall be constructed of PVC, nominally schedule 40 weight. If installation will enclose utility company provided conductors, verify exact type required and install in accordance with their standards, where more stringent than this specification in normal building conditions.
3. Rigid non-metallic conduit may be used in exterior wet or damp locations where installed underslab or underground. It shall not be run in interior locations, except with special permission from the Engineer for use in corrosive environments, and then only if protected from physical damage. No rigid non-metallic conduit may be installed in environmental air plenums or cast into above-grade concrete slabs. No rigid nonmetallic conduit may be installed in locations where the ambient temperature might exceed the rating of the raceway.
4. Where rigid non-metallic conduit is placed underground, as for feeder circuits, secondaries or branch circuit runs and where ell is made upward thru a slab on grade, transition the turning ell and the riser to rigid steel conduit to a height of 6" above the concrete slab.
5. Flexible non-metallic conduit shall not be used, except by special permission, obtained in writing from the Engineer.
6. Provide equipment grounding conductors of copper, sized as required by codes, in all circuits installed in rigid nonmetallic raceways.
7. Manufactured in conformance with UL standards.
8. Comply with NEMA TC 2 and NEMA TC 3.

J. RACEWAY FITTINGS

1. Fixture whips shall be 1/2" flexible, with clamp-on steel fittings at each end, six foot maximum length, with insulated throat bushings at each end and bonding locknuts. Wiring thru fixture whips shall be #12 AWG, with #12 AWG ground bonded to outlet at source end.

2. Raceway fittings (or condulets) shall be of gray iron, malleable iron or heavy copper-free cast aluminum. They shall be furnished in proper configurations, avoiding excessive plugged openings. Any openings that are left shall be properly plugged. All coverplates shall be gasketed with neoprene or similar approved materials, rated for the environment. Wiring splices within are not permitted.
3. Where required, raceway fittings shall be provided in explosion-proof configurations rated for the atmosphere. Place conduit seal off fittings at each device in accord with applicable codes. Seal off fittings shall be packed with wadding, and poured with an approved non-shrink sealing compound.
4. Where conduit transitions in a run from a cold to a warm environment, (such as at a freezer, refrigerator or exterior wall) sealoff fittings shall be placed on the warm side immediately at the boundary to prevent migration of condensation within raceway systems.
5. Conduit bodies, junction boxes and fittings shall be dust tight and threaded for dusty areas, weatherproof for exterior locations and vapor tight for damp areas. Conduit fittings shall be as manufactured by Crouse Hinds, Appleton, Killark or approved equivalent. All surface mounted conduit fittings as with "FS", "FD", "GUB" Types etc., shall be provided with mounting hubs.
6. Where lighting fixtures, appliances or wiring devices are to be suspended from ceiling outlet boxes, they shall be provided with 3/4" rigid conduit pendants. Outlet boxes shall be malleable iron, provided with self-aligning covers with swivel ball joint and #14 gauge steel locking ring. Provide safety chain between building structure and ballast housing of light fixtures for all fixtures, appliances or devices greater than 10 lbs weight. Fixtures shall be installed plumb and level. Cover pendants shall be finished to match fixtures.
7. UL listed expansion/deflection fitting shall be provided at all locations where a raceway/conduit crosses a structural joint intended for expansion, contraction or deflection. Other approved means may be acceptable with permission of the Engineer. Provide copper ground bonding jumpers across expansion fittings.
8. Fittings for threaded raceways shall be tapered thread with all burrs removed, reamed ends and cutting oil wiped clean.
9. Fittings for EMT conduits 2-1/2" and smaller shall be of steel, compression type. Fittings for sizes larger than 2-1/2" shall be setscrew, with two setscrews each side. Conduit stops shall be formed in center of couplings. All EMT connectors and couplings shall be of formed steel construction. All connectors shall be insulated throat type.
10. Indentation or die-cast fittings shall not be permitted in any raceway system.
11. Compression type fittings shall be utilized for EMT conduit installed in damp or dusty locations, or where otherwise indicated.
12. All conduit fittings shall be securely tightened. All threaded fittings shall engage seven full threads. Fasteners shall be properly torqued to manufacturer's recommendations.
13. Comply with NEMA FB1 and UL 514B.

2.2 SURFACE MOUNTED METAL RACEWAY

- A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 1. Wiremold
 2. Istrol
 3. Hubbell
- B. Surface metal raceways shall only be provided where indicated on the drawings.
- C. System: Provide surface raceway systems for branch circuit and data network voice, video and other low-voltage wiring. Surface raceway system shall consist of raceway bases, covers, pre-divided raceway bases, dual covers, appropriate fittings and device mounting plates necessary for a complete installation.
- D. Surface metal raceways shall be constructed of code gauge corrosion-resistant galvanized steel or aluminum extrusions, and finished in an ivory, buff or grey color as selected by the Architect. Finishes shall be suitable for field painting, prepared by the installing Contractor as necessary.

- E. Surface metal raceways, where used as raceways only, shall be sized for the conductors indicated. Nominal minimum size of such raceways shall be equivalent to Wiremold Co. Series #700, or equivalent by Walkerdect, Isotrol or other approved manufacturer.
- F. Surface metal raceways to be furnished with integral receptacles shall have Simplex Nema 5-20R outlets spaced on centers as indicated on plans. These shall be Wiremold Co. #2200 Series or equivalent Walkerdect, Isotrol or other approved manufacturer.
- G. Surface Mounted Aluminum Raceways: ALDS4000 Dual Channel Aluminum Surface Raceway by The Wiremold Company.
 - 1. Material: Alloy 6063-T5 extruded aluminum; minimum thickness 0.050-inches.
 - 2. Finish: Satin, No. 204 clear anodized, 0.004-inch thick, Class R1 Mil-Spec.
 - 3. Device Cover Plates: Suitable to mount commercially available duplex devices, single 1.40" and 1.59" diameter receptacles. GFCI, surge receptacles and other rectangular faced devices, and voice and data jacks. Cover plates shall be removable using standard screwdriver without marring the finish.
- H. Surface metal raceways and all components and fittings shall be furnished by a single manufacturer, wherever practical. All trim and cover fittings, flush feed boxes, splices, outlet fittings, etc, necessary for a complete installation shall be provided by the installing contractor. These raceways shall be rigidly mounted with approved fasteners on not to exceed 24" centers in a run, or 6" from ends and on either side of a corner. Refer to plans for notations on exact types of these raceways and outlet configurations.

2.3 METAL WIREWAYS AND AUXILIARY GUTTERS

- A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - 1. Cooper B-Line, Inc.
 - 2. Hoffman; a Pentair company.
 - 3. Mono-Systems, Inc.
 - 4. Square D; a brand of Schneider Electric.
- B. Description: Sheet metal, complying with UL 870 and NEMA 250, Type 1 unless otherwise indicated, and sized according to NFPA 70. Minimum of 14 gauge steel before finishes are applied.
 - 1. Metal wireways installed outdoors shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- C. Fittings and Accessories: Include covers, couplings, offsets, elbows, expansion joints, adapters, hold-down straps, end caps, and other fittings to match and mate with wireways as required for complete system.
- D. Wireways of painted steel construction shall be corrosion-resistant, moisture and oil resistant where indicated or necessary. Wireways shall be furnished in nominal sizes of 2 ½ " X 2 ½ ", 4" X 4", 6" X 6", 8" X 8" or 12" X 12", as indicated on plans. Furnish with hinged covers on all runs and removable covers on all fittings, to allow a continuous unobstructed path for conductor installation. Provide knockouts on all runs, unless otherwise indicated or prohibited by codes.
- E. Provide wireways with hangers of same manufacturer, installed so as to allow unobstructed access to wireway interior. Install at not to exceed 8'-0" centers, closer as needed at fittings and turns. Use ¼ " rod hangers minimum for up to 4"X 4", 3/8 " rod minimum up to 8"X 8", ½ " rod minimum for 12" X 12".
- F. Wireway Covers: Furnish with continuous hinged covers on all runs and removable covers on all fittings, to allow a continuous unobstructed path for conductor installation.
- G. Finish: Manufacturer's standard enamel finish.

2.4 WALL DUCTS

- A. Where wall duct type raceways are indicated to be installed flush, they shall be a minimum 3 ½ " deep by 10" wide (or 18" width, as indicated), furnished with screw covers to overlap flange 1" on each side. Covers shall be furnished in nominal 3'-0" lengths. Provide fully grommated openings or bushed nipples as needed in coverplates to pass cables thru. Where indicated or required, provide transition fittings between horizontal runs of wireway and wall ducts to properly interface each raceway system.
- B. Where wall ducts are installed flush either vertically or horizontally as a collector duct, provide proper blocking and support in stud walls, adding a layer of studs as needed to prevent undercutting major structural elements of walls. Trim flange shall be set tight to wall surface with 1/16" tolerance each way.
- C. Wall ducts, if indicated to be surface mounted, shall be furnished with flangeless coverplates.
- D. All completed systems shall be provided with a factory prime painted finish, suitable for field finish painting.
- E. Wall ducts shall be equivalent to Square D Company "RWT" Series, as a standard of construction and quality.

2.5 TRENCH DUCTS

- A. Trench duct is to be installed flush with finished concrete floor slab with a vertical tolerance to adjacent surfaces of 1/16" plus or minus. Nominal depth of trench duct shall be adjustable from 2 3/8" to 3 ½ ", minimum 12" width unless otherwise noted on plans.
- B. Trench duct shall be constructed of code-gauge steel, 14 gauge minimum, with corrosion resistant finish. Surfaces of duct or fittings in contact with concrete shall be painted with two coats of "Asphaltum" or receive equivalent coating or taping prior to placement of concrete.
- C. Furnish trench duct with flat turns, riser transition fittings to wall duct or panelboard as shown, concrete tight couplings, internal barriers as required to separate services, reducers, end closers, tees and all other fittings as indicated or required.
- D. Furnish coverplates of aluminum, ¼ " thickness minimum, with flush fasteners in nominal 24" lengths. Furnish grommated openings or nipples with insulated bushings as required. Coverplates shall not deflect more than .085" with application of a 200 pound concentrated load. Any compartment over 16" in width shall have additional coverplate support, to meet the deflection criteria above.
- E. Provide (as standard) an aluminum tile trim flange (verify and coordinate with floor finishes). Refer to architectural drawings, where applicable.
- F. Trench duct and coverplates shall be equivalent to Square "D" Company RSV/RCP-AL series, as a standard of quality and construction.

2.6 CABLE TRAY OR CABLE TROUGH

- A. Cable tray shall be furnished in all-aluminum construction or galvanized steel construction, as noted and sized on the drawings.
- B. Galvanized finishes on tray shall be hot-dipped after fabrication for all tray in exterior locations. Mill finished galvanizing may be used where tray is installed indoors in dry locations.
- C. The installing Contractor shall carefully follow the manufacturer's recommendations for hanger sizing and hanger support spacing. The weight per linear foot of tray, fully loaded with a 200% safety factor shall be accounted for in sizing hangers. Refer to manufacturer's instructions and/or the drawings, as applicable for hangers and supports. In no case shall supports be spaced further than 8'-0" apart.
- D. Cable tray shall be of the size and type as indicated on drawings.
- E. Cable trough shall be similar to cable tray, except bottom shall be a ribbed solid piece, depth and width as indicated on the drawings.
- F. Cable tray or trough shall be provided with all required fittings for a complete installation. Fittings shall include, but not be limited to: Horizontal and vertical elbows and tees, smooth dropout fittings, end

closure plates, fixed (or adjustable) splices as needed for field offsets, reducers, barriers or box connector flanges.

- G. Cable tray and trough shall be equivalent to Square "D" Company Series CLA/CLG (ladder tray) or CTA/CTG (trough) as a standard of quality and construction, unless otherwise noted on plans.

2.7 DUCT BANKS

- A. Duct banks are defined as a raceway or raceways installed in underground locations, enclosed in a steel-reinforced concrete envelope. They shall be installed where indicated on the drawings or otherwise required.
- B. All concrete used in duct bank construction shall be 3000 PSI minimum 28 day compressive strength unless otherwise noted, in accordance with latest A.C.I. standards. Testing of concrete shall be the responsibility of the Contractor, as directed by the engineer. Place concrete against undisturbed earth, or provide forming as needed.
- C. Duct bank raceways shall receive a minimum of 3" concrete cover all sides. Minimum size of any duct bank shall be 12" x 12" square, in cross section. In all cases, local and national codes shall apply to duct bank construction where they exceed the requirements of this specification.
- D. Each corner of duct bank shall receive a minimum No. 4 steel reinforcing bar with 2" minimum concrete cover on all sides. Lap bars fifteen diameters at all splices. Reinforcing steel shall be rigidly supported during pour and vibration, and shall be constructed to ASTM standards.
- E. Support for encased raceways shall be as recommended by raceway manufacturer, spaced 8'-0" maximum on centers, rigidly fastened to prevent floating of ducts during concrete pours. Supports shall be of a material compatible with the raceway, and shall be of the interlocking type, forming a rigidly braced installation. Provide base type and intermediate type spacers to suit conduit configurations and sizes.
- F. Where rigid nonmetallic raceways leave concrete duct banks, a transition to rigid steel conduit shall be made 18" inside the concrete envelope. Under no circumstances shall PVC, EB or similar ducts exit concrete envelope, except where duct bank ties into a manhole wall. Provide bell ends at such terminations and towel duct bank rebars 4" into manhole wall with grout. Refer to details on drawings, as applicable. Slope all raceways within duct bank systems such that they shall drain into manholes or pull boxes. Provide proper drainage at manholes or pull boxes to prevent water accumulation.
- G. Where ducts transition thru manholes, pull boxes or at terminating end, each duct shall be specifically identified. A nomenclature as shown on the drawings or as agreed upon by the installer and engineer shall be utilized to identify each individual duct. A permanent means of identifying each duct, such as engraved lamacoid plates or stamped metal tags shall be used.

2.8 SUPPORTS AND HANGERS

- A. Supports and hangers shall be installed in accord with all applicable codes and standards. They shall be corrosion - resistant, galvanized or furnished with an equivalent protective coating. All electrical raceways shall be hung independently from the building structure with UL listed and approved materials. Hangers and supports depending from the support systems of other trades work shall not be permitted, except with specific approval in writing from the Engineer. The use of tie wire for support or fastening of any raceway system is prohibited. Perforated metal tape shall not be used for raceway support.
- B. No raceway shall be installed on acoustic tile ceiling tees, or in any location that will impair the functioning, access or code-required clearances for any equipment or system.
- C. Supports for raceways shall be of materials compatible with the raceway, of malleable iron, spring steel, stamped steel or other approved material. Die-cast fittings are not permitted for supports.
- D. The installing contractor shall provide all necessary supports and braces for raceways, in a rigid and safe installation, complying with all applicable codes.
- E. Individual conduits routed on building walls, ceilings or equipment shall be secured by two- hole galvanized malleable iron or stamped steel pipe strap or "minerallac" 2-piece straps. The straps are to be

anchored by an approved means such as expansion anchors, toggle bolts, through bolts, etc. Where required by codes or other standards, provide spacers behind mounting clamps to space conduits off walls.

- F. Supports may not be fastened to roof decking on drive pins.
 - G. Individual conduits run on building steel shall be secured by means of clamp supports similar and equal to those manufactured by the C.C. Korn Company, Elcen Co., B-Line or approved equivalent. Provide korn clamps, bulb-tee, flange clamps, beam clamps, "minerallacs", etc.
 - H. Where feasible, vertical and/or horizontal runs of conduit shall be grouped in common hangers on "trapezes" of channel stock as manufactured by "Unistrut" or equivalent, 1-5/8" minimum depth. Utilize conduit clamps appropriate to the channel.
 - I. Channel strut systems for supporting electrical equipment or raceways shall be constructed of 16 gauge minimum hot dip galvanized steel with 9/16" diameter holes on 8" centers, with finish coat of paint as manufactured by Unistrut, B-Line, Kindorf, or approved equivalent.
 - J. The minimum diameter of round all-thread steel rods used for hangers and supports shall be 1/4", 20 threads per inch. All-thread rod shall be furnished with a corrosion-resistant finish.
 - K. Welding directly on conduit or fittings is not permitted.
 - L. Provide riser support clamps for vertical conduit runs. Riser support clamps shall be of heavy gauge steel construction. Install riser support clamps at each floor level penetration, or as otherwise required.
 - M. Provide conduit cable support clamps for vertical conductor runs as required or indicated on plans. Clamps to be insulating wedging plug, with malleable iron support ring. Install within properly sized and anchored junction box.
 - N. Spring steel clips and fittings such as those manufactured by HITT-Thomas, Caddy-Erico, or approved equivalent, with black oxide finish are permitted in any indoor dry location for concealed work, where acceptable to the local authority having jurisdiction.
 - O. Raceways shall be securely and rigidly fastened in place at intervals specified here-in-before with wall brackets, conduit clamps, approved conduit hangers, or beam clamps. Fastenings shall be made by wood screws or screw type nails to wood; by toggle bolts on hollow masonry units; by expansion bolts on concrete or brick; by machine screws, welded threaded studs, heat treated or spring steel tension clamps on steel work. Bolts, screws, etc. used in securing the work shall be galvanized and of ample size for the service. Assembly bolts, nuts, washers, etc., shall be zinc or cadmium coated. Raceways shall not be welded to steel structures. Holes cut to a depth of more than 1-1/2 inches in reinforced concrete beams or to a depth of more than 3/4 inch in concrete joists shall avoid cutting the main reinforcing bars.
 - P. The use of perforated iron straps or wire for supporting conduits will not be permitted.
 - Q. Where conduits are installed in groups on a common steel channel type support, each conduit shall be secured by Korn's, Unistrut, Kindorf clamps or equal.
 - R. Rigid conduits, where they enter panelboards, cabinets or pull boxes shall be secured in place by galvanized, double locknuts (one inside and one outside) and non-metallic bushings. All bushings shall have insulating material which has been permanently fastened to the fittings. Bushings for conduit 1-1/2 inches trade size and larger, which are used for power distribution, shall be complete with grounding lug and shall be bonded to the box by means of bare copper wire.
- 2.9 FIRESTOPPING MATERIALS
- A. All conduits and cables penetrating fire or smoke rated floors, walls and ceilings shall be firestopped. Firestopping assembly must be UL listed. All corridor walls, storage room walls and mechanical room walls are to be considered minimum one-hour fire rated. Elevated slabs and floors shall also be considered minimum one-hour rated. Refer to Architectural drawings for additional rating requirements.

- B. Provide shop drawings indicating penetration detail for each type of wall and floor construction. Shop drawings must be specific for each individual type. (i.e., one-hour fire rated gypsum wall board with insulated metal pipe penetration.)
- C. 3M fire protection products are listed below. Equivalent products may be submitted if they are UL listed.
- D. The manufacturer of the firestopping materials must provide on site training for the contractor. The training session shall demonstrate to the contractors the proper installation techniques for all the firestopping materials. The training session shall be four hours minimum. Contact the Engineer prior to conducting this training session.
- E. Firestopping materials to include but not limited to the following:
 - 1. 3M fire barrier FS-195 wrap/strip.
 - 2. 3M fire barrier CP 25 caulk.
 - 3. 3M fire barrier MP moldable putty.
 - 4. 3M fire barrier RC-1 restricting collar with steel hose clamp.
 - 5. 3M fire barrier damming materials.
 - 6. 3M fire barrier CS-195 composite sheet.
 - 7. 3M fire barrier fire dam 150 caulk.
 - 8. Steel sleeves.

2.10 SPECIALTIES

- A. All EMT terminations at junction boxes, panels, etc. shall be made with case hardened locknuts and appropriate fittings, with insulated throat liners. Insulating terminations shall be manufactured as a single unit. The use of split sleeve insulators is not permitted.
- B. All rigid conduit, except main and branch feeders, shall have heavy fiber insulating bushings reinforced with double locknuts. All branch and main feeders shall have insulated bushings with grounding lugs and shall be bonded to enclosures with appropriately sized copper jumpers, except at pad mounted transformers. Bonding jumpers shall be installed as required by the NEC and other applicable codes.
- C. All conduit stubbed through floor during construction shall have openings protected with plastic caps approved for this purpose. Connections on both ends of all flexible conduit shall be equivalent to Thomas and Betts, Ideal, Appleton, Efcor, or approved equivalent, rated for the environment.
- D. Nylon pull strings shall be provided in all empty conduit and in all conduit installed for other trades. Pull strings shall be left securely tied off at each end.
- E. Where spare raceways terminate in switchboards or motor control centers a fishtape barrier shall be provided.
- F. All outlet, junction and pull boxes shall be grounded with pigtail to the equipment grounding conductor.
- G. All fire alarm raceways in concealed areas, data/mechanical/electrical rooms and above ceilings shall be red. Exposed fire alarm raceways shall match adjacent finishes.
- H. All junction, outlet and pull boxes in data/mechanical/electrical rooms and above ceilings shall be identified with panel and circuit designation on outside of covers. All junction, outlet and pull boxes in exposed areas shall be identified with panel and circuit designation on inside of covers.

PART 3 - EXECUTION

3.1 RACEWAY APPLICATION

- A. Outdoors: Apply raceway products as specified below unless otherwise indicated:
 - 1. Exposed Conduit: GRC
 - 2. Concealed Conduit, Aboveground: GRC
 - 3. Underslab Conduit: Concrete encased GRC.

4. Underslab Medium-Voltage Conduit: Concrete encased GRC.
 5. Refer to Section 260543, "Underground Ducts And Raceways For Electrical Systems" for additional requirements.
- B. Indoors: Apply raceway products as specified below unless otherwise indicated:
1. Concealed in Ceilings and Interior Walls and Partitions: EMT, IMC or GRC
 2. Connection to Vibrating Equipment (Including Transformers and Hydraulic, Pneumatic, Electric Solenoid, or Motor-Driven Equipment): FMC, except use LFMC in damp or wet locations.
 3. Damp or Wet Locations: GRC
 4. Exposed, Not Subject to Physical Damage: GRC, IMC or EMT. Raceway locations include the following:
 - a. Electrical Rooms
 5. Exposed and Subject to Severe Physical Damage: GRC. Raceway locations include the following:
 - a. Loading dock.
 - b. Corridors used for traffic of mechanized carts, forklifts, and pallet-handling units.
 - c. Mechanical rooms (below 8'-0").
 - d. Gymnasiums.
- C. Raceway Fittings: Compatible with raceways and suitable for use and location.
1. Rigid and Intermediate Steel Conduit: Use threaded rigid steel conduit fittings unless otherwise indicated. Comply with NEMA FB 2.10.
 2. PVC Externally Coated, Rigid Steel Conduits: Use only fittings listed for use with this type of conduit. Patch and seal all joints, nicks, and scrapes in PVC coating after installing conduits and fittings. Use sealant recommended by fitting manufacturer and apply in thickness and number of coats recommended by manufacturer.
 3. EMT: Use compression, steel fittings. Comply with NEMA FB 2.10.
 4. Flexible Conduit: Use only fittings listed for use with flexible conduit. Comply with NEMA FB 2.20.
- D. Install nonferrous conduit or tubing for circuits operating above 60 Hz. Where aluminum raceways are installed for such circuits and pass through concrete, install in nonmetallic sleeve.
- E. Do not install aluminum conduits, boxes, or fittings in contact with concrete or earth.
- F. Install surface raceways only where indicated on Drawings.
- G. PVC conduit and plastic molding are not acceptable except in caustic environments.
- H. Aluminum is not acceptable in caustic environments.
- 3.2 INSTALLATION
- A. Comply with NECA 1 and NECA 101 for installation requirements except where requirements on Drawings or in this article are stricter. Comply with NECA 102 for aluminum conduits. Comply with NFPA 70 limitations for types of raceways allowed in specific occupancies and number of floors.
 - B. This Contractor shall lay-out and install all conduit systems so as to avoid any other service or systems, the proximity of which may prove injurious to the conduit, or conductors which it confines. All conduit systems, except those otherwise specifically shown to the contrary, shall be concealed in the building construction or run above ceilings. Size of all conduit shall conform to Annex C, of the National Electrical Code, unless otherwise shown on the Contract Drawings.
 - C. Conceal conduit and EMT within finished walls, ceilings, and floors unless otherwise indicated. Install conduits parallel or perpendicular to building lines.
 - D. Support conduit within 12 inches of enclosures to which attached.

- E. No conduit shall be installed in or below poured concrete slabs except with permission of the architect or engineer. Conduit shall be held at least 12" from flues, steam or hot water pipes.
- F. All conduits in slab, under slab and in areas subject to abuse shall be shall be galvanized rigid steel with threaded fittings or rigid PVC Conduit encased in 3" (minimum) and steel reinforced concrete with dye identification.
- G. Intermediate grade conduit will not be acceptable in place of galvanized rigid steel conduit.
- H. All exposed conduit shall be installed with runs parallel or perpendicular to walls, structural members or intersections of vertical planes and ceilings, with right angle turns consisting of cast metal fittings or symmetrical bends unless otherwise shown. All conduit shall have supports spaced not more than eight feet apart. Randomly routed conduits will not be acceptable.
- I. Conduit shall be installed in such a manner so as to insure against collection of trapped condensation. All runs of conduit shall be arranged so as to be devoid of traps. Trapped conduit runs shall be provided with explosion proof drains at low points. Runs of conduit between junctions shall not have more than the equivalent of three 90° bends.
- J. Junction boxes shall be installed so that conduit runs will not exceed 50', or as shown on the Contract Drawings. Junction boxes shall be sized per NEC, Article 370.
- K. Install electrical raceways in accordance with manufacturer's written instructions, applicable requirements of latest edition of the NEC, and NECA "Standard of Installation", complying with recognized industry practices.
- L. Coordinate with other trades, including metal and concrete deck trades, as necessary to interface installation of electrical raceways and components.
- M. Level and square raceway runs, and install at proper elevations and required heights. Hold tight to structure wherever possible, to maximize available space and not restrict other trades.
- N. Complete installation of electrical raceways before starting installation of cables or wires within raceways.
- O. Bushings shall be provided on conduits to protect cables transitioning from conduits to cable tray pathway.
- P. Provide plastic bushings on the end of all conduit stub-ups.
- Q. Install electrical raceways in accordance with manufacturer's written instructions, applicable requirements of latest edition of the NEC, and NECA "Standard of Installation", complying with recognized industry practices.
- R. Coordinate with other trades, including metal and concrete deck trades, as necessary to interface installation of electrical raceways and components.
- S. Level and square raceway runs, and install at proper elevations and required heights. Hold tight to structure wherever possible, to maximize available space and not restrict other trades.
- T. Raceways installed in exterior locations shall receive one coat of primer, two coats finish paint after preparation of galvanizing, color selected by Architect. Exposed raceways in painted interior areas shall be similarly painted.
- U. Conduits, cables, raceways, and enclosures under metal-corrugated sheet roof decking shall not be located within 1-1/2" of the roof decking, measured from the lowest surface of the roof decking to the top of the conduit, cable, raceway, or box. GRS is acceptable to route tight to bottom of roof deck.
- V. Conduits, cables, raceways, and enclosures are not permitted in concealed locations of metal-corrugated sheet decking type roofing.
- W. All conduit, tubing, raceways, ducts and duct banks shall be installed in such manner as to insure against collection of trapped condensation and raceway runs shall be arranged so as to be devoid of traps.

- X. Where conduits pass through exterior concrete walls of facilities, the entrance shall be made watertight. This shall be done by providing pipe sleeves in the concrete with 1/2" minimum entrance seal.
- Y. All necessary precautions to prevent the lodgment of dirt, plaster, or trash in all conduit or tubing, fittings and boxes during construction shall be taken. All conduit in floors, concrete or below grade shall be swabbed free of debris or moisture before wires are pulled.
- Z. Liquid-tight flexible steel conduit shall be used for connections to all vibrating equipment, including motors and transformers, with a minimum of 18-inches of flex looped to avoid restraining equipment vibrating.
- AA. Stub-ups to Above Recessed Ceilings:
 - 1. Use EMT for raceways.
 - 2. Use a conduit bushing or insulated fitting to terminate stub-ups not terminated in hubs or in an enclosure.
- BB. Grounding bushings and bonding jumpers shall be used on conduit terminations at all junction boxes, pull boxes and cabinets to maintain grounding integrity of conduit system.
- CC. Do not install conduits or raceways on exterior facades or within wall cavities.
- DD. All conduit and PVC conduits installed below grade or below slabs (where indicated) shall be concrete encased.
- EE. Do not drill into bar joists to support raceways or cables.
- FF. All utilities and underground conduits shall be surveyed and recorded on as-built drawings.
- GG. All exterior conduits and raceways shall be painted.
- HH. All floor slabs and concrete walls shall be x-rayed before cutting.
- II. Contractor must maintain a minimum 12" clear space above, 6" below and a minimum 26" clear on one side of all cable trays and wireways (both new and existing).
- JJ. Absolutely no "LB's" are allowed in any communications conduit installation.
- KK. Conduit ends at a wireway will be mechanically fastened, have plastic bushings, and be wire bonded to the wireway.
- LL. Underground electric, cable TV, telephone service or other rigid steel conduit and underfloor rigid steel conduit below the concrete floor slab shall be painted with two coats of bitumastic paint, such as "Asphaltum".
- MM. All underground or underfloor conduits shall be swabbed free of all moisture and debris before conductors are pulled.
- NN. At least two (2) 1" and three (3) 3/4" conduits shall be stubbed from all flush-mounted panelboards into the nearest accessible area for future use. Provide suitable closures for these stubs. Identify each stub with a suitable hang tag.
- OO. Coordinate with other trades, including metal and concrete deck trades, as necessary to interface installation of electrical raceways and components.
- PP. All underground conduits shall be buried to minimum depth of 24" from the top of the concrete encasement or raceway to finished grade, unless otherwise noted on plans. Observe minimum burial requirements of local utility company where their standards or regulations apply. Conduits containing primary power conductors, (higher than 600 volts to ground) shall be 48" to top below finished grade, unless otherwise noted on plans. Conduits containing secondary power conductors, (600 volts and less to ground) shall be 36" to top below finished grade, unless otherwise noted on plans.
- QQ. Provide uni-strut racks where multiple conduits are supported at one location.

- RR. Provide separate a completely separate raceway system of conduits, pull-boxes, etc. for each emergency power branch and for normal power for complete separation per NEC.
- SS. Where existing panels are flush-mounted in walls, contractor shall cut, patch, and repair existing construction as required for concealed conduit entry for new connections to those panels.
- TT. Expansion-Joint Fittings:
1. Install expansion fittings at all locations where conduits cross building or structure expansion joints.
 2. Install each expansion-joint fitting with position, mounting, and piston setting selected according to manufacturer's written instructions for conditions at specific location at time of installation. Install conduit supports to allow for expansion movement.
- UU. Surface Raceways:
1. Install surface raceway with a minimum 2-inch radius control at bend points.
 2. Secure surface raceway with screws or other anchor-type devices at intervals not exceeding 48 inches and with no less than two supports per straight raceway section. Support surface raceway according to manufacturer's written instructions. Tape and glue are not acceptable support methods.

3.3 PROTECTION

- A. Protect coatings, finishes, and cabinets from damage and deterioration.
1. Repair damage to galvanized finishes with zinc-rich paint recommended by manufacturer.
 2. Repair damage to PVC coatings or paint finishes with matching touchup coating recommended by manufacturer.

3.4 SPECIALTIES

- A. All EMT terminations at junction boxes, panels, etc. shall be made with case hardened locknuts and appropriate fittings, with insulated throat liners. Insulating terminations shall be manufactured as a single unit. The use of split sleeve insulators is not permitted.
- B. All rigid conduit, except main and branch feeders, shall have heavy fiber insulating bushings reinforced with double locknuts. All branch and main feeders shall have insulated bushings with grounding lugs and shall be bonded to enclosures with appropriately sized copper jumpers, except at pad mounted transformers. Bonding jumpers shall be installed as required by the NEC and other applicable codes.
- C. All conduit stubbed through floor during construction shall have openings protected with plastic caps approved for this purpose. Connections on both ends of all flexible conduit shall be equivalent to Thomas and Betts, Ideal, Appleton, Efcor, or approved equivalent, rated for the environment.
- D. Pulling lines shall be left in all open conduit systems and shall be non-metallic, left securely tied off at each end cap any unused conduits.
- E. Where spare raceways terminate in switchboards or motor control centers a fishtape barrier shall be provided.
- F. All metal boxes, junction boxes and pull boxes shall be grounded with pigtailed to the equipment grounding conductor.
- G. All empty raceways inside switchgear and open spaces shall be capped.
- H. All fire alarm raceways shall be red. Painted red conduit will not be accepted. Junction and pull boxes shall be identified with panel and circuit number on covers.
- I. All emergency power raceways shall be blue. Painted conduit will not be accepted. Junction and pull boxes shall be identified with panel and circuit number on covers.

- J. All conduits in theaters shall be black. Painted conduit will not be accepted. Junction and pull boxes shall be black and identified with panel and circuit number on inside of covers.

END OF SECTION

DIVISION 26 – ELECTRICAL

SECTION 260535 - CABINETS, OUTLET BOXES AND PULL BOXES FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General, Special and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.
- B. The Contractor is directed to examine each and every section of these specifications, all drawings relating to the Contract Documents, any and all Addenda, etc., for work described elsewhere that may relate to the provision of the work described herein. Materials and performance requirements are specified elsewhere herein that relate to these systems.
- C. Each Electrical Contractor's attention is directed to Section 260501 - General Provisions, Electrical, and all other Contract Documents as they apply to his work.

1.2 SUMMARY

- A. Section Includes: Boxes, enclosures, and cabinets.

PART 2 - PRODUCTS

2.1 CABINETS, OUTLETS AND PULL BOXES

- A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - 1. Adalet.
 - 2. Cooper Technologies Company; Cooper Crouse-Hinds.
 - 3. EGS/Appleton Electric.
 - 4. Erickson Electrical Equipment Company.
 - 5. FSR Inc.
 - 6. Hoffman; a Pentair company.
 - 7. Hubbell Incorporated; Killark Division.
 - 8. Kraloy.
 - 9. Milbank Manufacturing Co.
 - 10. Mono-Systems, Inc.
 - 11. O-Z/Gedney; a brand of EGS Electrical Group.
 - 12. RACO; a Hubbell Company.
 - 13. Robroy Industries.
 - 14. Spring City Electrical Manufacturing Company.
 - 15. Stahlin Non-Metallic Enclosures; a division of Robroy Industries.
 - 16. Thomas & Betts Corporation.
 - 17. Wiremold / Legrand.
- B. Cabinets for lighting and power, telephone, pull boxes, outlet boxes, or any other purposes specified or shown on the Contract Drawings, shall be constructed of code gauge, galvanized steel with sides formed and corner seams riveted or welded before galvanizing. Boxes assembled with sheet metal screws will not be accepted. Pull boxes shall include all boxes used to reduce the run of conduit to the required number of feet or bends, supports, taps, troughs, and similar applications and shall also be constructed as specified above.
- C. All cabinets and boxes for NEMA 1 and 1A application shall be provided with knockouts, as necessary, or shall be cut in the field by approved cutting tools which will provide a clean, symmetrically cut opening. All boxes, except panelboards, shall be provided with code gauge fronts with hex head or pan head screw fasteners. Fronts for panelboards shall be as specified for panelboards.

- D. Ceiling outlet boxes shall be galvanized steel, 4" octagonal, not less than 2 1/8" deep, with lugs or ears to secure covers, and those for use with ceiling lighting fixtures shall be fitted with 3/8" fixture studs fastened to the back of the boxes, where applicable. Provide adequate support with at least a 2 x safety factor for the anticipated fixture weight.
- E. Special size concealed outlet boxes for alarms, TV, etc., shall be provided by the manufacturer of the equipment.
- F. The location of outlets, as shown on the drawings, shall be considered as approximate only. It shall be incumbent upon this Contractor to study the general building drawings, with relation to spaces surrounding each outlet, in order to make his work fit the work of others and in order that when the devices or fixtures are installed, they will be symmetrically located and will not interfere with any other work or equipment. Any change in fixture or layout shall be coordinated with and approved by the Engineer before this change is made. Regardless of the orientation shown on the drawings, all devices shall be easily accessible when installed.
- G. All outlets, pull boxes, junction boxes, cabinets, etc., shall be sized per the current edition of the National Electrical Code.
- H. General Requirements for Boxes, Enclosures, and Cabinets: Boxes, enclosures, and cabinets installed in wet locations shall be listed for use in wet locations.
- I. Outlet boxes and junction or pull boxes shall be threaded for rigid-threaded conduit, dust-tight vapor-tight or weatherproof as required for areas other than for NEMA 1 or 1A application. These shall be as manufactured by Crouse-Hinds, Appleton, Killark, or approved as equivalent.
- J. Sheet Metal Outlet and Device Boxes: Comply with NEMA OS 1 and UL 514A.
- K. Cast-Metal Outlet and Device Boxes: Comply with NEMA FB 1, ferrous alloy or aluminum, Type FD, with gasketed cover.
- L. Luminaire Outlet Boxes: Nonadjustable, designed for attachment of luminaire weighing 50 lb. Outlet boxes designed for attachment of luminaires weighing more than 50 lb shall be listed and marked for the maximum allowable weight.
- M. Paddle Fan Outlet Boxes: Nonadjustable, designed for attachment of paddle fan weighing 70 lb.
 - 1. Listing and Labeling: Paddle fan outlet boxes shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- N. NEMA 1 or 1A outlet boxes or pull or junction boxes shall be as manufactured by Appleton, Steel City, T & B, or approved equivalent.
 - 1. Outlet boxes for switches, receptacles, etc., concealed in walls shall be galvanized steel, 4" x 4" x 2 1/8" deep with plaster cover for the number of devices as required and to be flush with finished wall. Where outlet boxes are installed in walls of glazed tile, brick, concrete block, or other masonry which will not be covered with plaster or in walls covered by wood wainscot or paneling, deep sectional masonry boxes shall be used and they shall be completely covered with the plates or lighting fixtures. This Contractor shall cooperate with the brick layers, block layers and carpenters to insure that the outlet boxes are installed straight and snugly in the walls. Receptacles shall be set vertically in walls.
 - 2. Outlet boxes for data/voice locations shall be as specified in Division 27.
- O. Unless otherwise noted on the drawings or in the specifications, outlet boxes shall be installed at the following heights to centerline of box:

Wall Switches, Control Stations.....3'-10"
 Convenience Outlets.....1'-6"

Note: Contractor is to refer to Architectural elevations and coordinate device mounting heights, quantities, and locations.

- P. Outlet boxes mounted in glazed tile, brick, concrete block or other types of masonry walls shall be mounted above or below the mortar joint. Do Not Split The Mortar Joint.
- Q. Boxes for more than two (2) devices shall be for number of devices required and shall be one piece. No ganging of single switch boxes will be allowed.
- R. Outlets provided shall have only the holes necessary to accommodate the conduit at the point of insulation and shall be rigidly secure in position. Boxes with knockout removed and openings not used shall be replaced or provided with a listed knockout closure.
- S. Exterior outlets shall be die-cast aluminum, weather-proof with gasketed covers and baked on grey enamel finish, per ANSI 61.
- T. Boxes up to 4-11/16 square size shall be fastened to their mounting surface with two fasteners of proper size. Larger sizes shall be fastened with four fasteners, minimum.
- U. Openings for conduit entrance in cabinets and boxes shall be prefabricated, punched, drilled and/or reamed. The use of a cutting torch for this purpose is prohibited.
- V. Aluminum is not acceptable in caustic environments.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Comply with NECA 1 and NECA 101 for installation requirements except where requirements on Drawings or in this article are stricter. Comply with NFPA 70 limitations for types of raceways allowed in specific occupancies and number of floors.
- B. Comply with requirements in Section 260533 "Raceways and Boxes for Electrical Systems."
- C. Install electrical boxes as required for splices, taps, wire pulling, equipment connections.
- D. Do not install flush mounting boxes back-to-back in walls; install with minimum 6-inches separation. Install with 24-inches separation in acoustic rated walls.
- E. Do not fasten boxes to ceiling support wires or other piping systems.
- F. Support all boxes independently of conduit.
- G. Grounding bushings and bonding jumpers shall be used on conduit terminations at all junction boxes, pull boxes and cabinets to maintain grounding integrity of conduit system.

3.2 PROTECTION

- A. Protect coatings, finishes, and cabinets from damage and deterioration.
 - 1. Repair damage to galvanized finishes with zinc-rich paint recommended by manufacturer.
 - 2. Repair damage to PVC coatings or paint finishes with matching touchup coating recommended by manufacturer.

END OF SECTION

DIVISION 26 – ELECTRICAL

SECTION 260543 - UNDERGROUND DUCTS AND RACEWAYS FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General, Special and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.
- B. The Contractor is directed to examine each and every section of these specifications, all drawings relating to the Contract Documents, any and all Addenda, etc., for work described elsewhere that may relate to the provision of the work described herein. Materials and performance requirements are specified elsewhere herein that relate to these systems.
- C. Each Electrical Contractor's attention is directed to Section 260501 - General Provisions, Electrical, and all other Contract Documents as they apply to his work.

1.2 SUMMARY

- A. Section Includes:
 - 1. Direct-buried conduit, ducts, and duct accessories.
 - 2. Concrete-encased conduit, ducts, and duct accessories.
 - 3. Handholes and boxes.
 - 4. Manholes.

1.3 DEFINITIONS

- A. Trafficways: Locations where vehicular or pedestrian traffic is a normal course of events.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product.
 - 1. Include duct-bank materials, including separators and miscellaneous components.
 - 2. Include ducts and conduits and their accessories, including elbows, end bells, bends, fittings, and solvent cement.
 - 3. Include accessories for manholes, handholes, boxes and other utility structures.
 - 4. Include warning tape.
- B. Shop Drawings:
 - 1. Precast or Factory-Fabricated Underground Utility Structures:
 - a. Drawings shall detail concrete and reinforcement requirements.
 - b. Include plans, elevations, sections, details, attachments to other work, and accessories.
 - c. Include duct entry provisions, including locations and duct sizes.
 - d. Include reinforcement details.
 - e. Include frame and cover design and manhole frame support rings.
 - f. Include Ladder details.
 - g. Include grounding details.
 - h. Include dimensioned locations of cable rack inserts, pulling-in and lifting irons, and sumps.
 - i. Include joint details.
 - 2. Factory-Fabricated Handholes and Boxes Other Than Precast Concrete:
 - a. Include dimensioned plans, sections, and elevations, and fabrication and installation details.
 - b. Include duct entry provisions, including locations and duct sizes.
 - c. Include cover design.

1.5 INFORMATIONAL SUBMITTALS

- A. Duct-Bank Coordination Drawings: Show duct profiles and coordination with other utilities and underground structures.
 - 1. Include plans and sections, drawn to scale, and show bends and locations of expansion fittings.
 - 2. Drawings shall be signed and sealed by a qualified professional engineer.
- B. Source quality-control reports.
- C. Field quality-control reports.

1.6 MAINTENANCE MATERIALS SUBMITTALS

- A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1.7 QUALITY ASSURANCE/WARRANTY

- A. Testing Agency Qualifications: Qualified according to ASTM E 329 for testing indicated.
- B. The manhole shall be provided with a manufacturer's warranty against leaks in the manhole resulting from cracks in the manhole structure. The length of this warranty shall be for five years from date of installation.

1.8 FIELD CONDITIONS

- A. Interruption of Existing Electrical Service: Do not interrupt electrical service to facilities occupied by Owner or others unless permitted under the following conditions, and then only after arranging to provide temporary electrical service according to requirements indicated:
 - 1. Notify Construction Manager no fewer than two weeks in advance of proposed interruption of electrical service.
 - 2. Do not proceed with interruption of electrical service without Construction Manager's written permission.
- B. Ground Water: Assume ground-water level is at grade level unless a lower water table is noted on Drawings.

1.9 SYSTEM COMMISSIONING

- A. Section 019113 requires the engagement of a Commissioning Authority to document the completion of the Mechanical, Fire Protection, Plumbing, Electrical, Electronic Safety and Security, and associated Control Systems for the project. Section 019113 defines the roles and responsibilities of each member of the commissioning team.
- B. Comply with the requirements of Section 019113 for the commissioning of the various building systems.

PART 2 - PRODUCTS

2.1 GENERAL REQUIREMENTS FOR DUCTS AND RACEWAYS

- A. Comply with ANSI C2.

2.2 CONDUIT

- A. Rigid Steel Conduit: Galvanized. Comply with ANSI C80.1.
- B. Rigid Nonmetallic Conduit (RNC): NEMA TC 2, Type EPC-40-PVC, UL 651, with matching fittings by same manufacturer as the conduit, complying with NEMA TC 3 and UL 514B.

2.3 NONMETALLIC DUCTS AND DUCT ACCESSORIES

- A. Underground Plastic Utilities Duct: NEMA TC 2, UL 651, ASTM F 512, Type EPC-40, with matching fittings complying with NEMA TC 3 by same manufacturer as the duct.
- B. Duct Accessories:
 - 1. Duct Separators: Factory-fabricated rigid PVC interlocking spacers, sized for type and size of ducts with which used, and selected to provide minimum duct spacing indicated while supporting ducts during concreting or backfilling.
 - 2. Warning Tape: Metallic Underground-line warning tape per published Owner's standards.

2.4 HANDHOLES AND BOXES

- A. General Requirements for Handholes and Boxes: Comply with SCTE 77. Tier 15.
 - 1. Color: Gray.
 - 2. Configuration: Units shall be designed for flush burial and have open bottom unless otherwise indicated.
 - 3. Cover: Weatherproof, secured by tamper-resistant locking devices and having structural load rating consistent with enclosure.
 - 4. Cover Finish: Nonskid finish shall have a minimum coefficient of friction of 0.50.
 - 5. Cover Legend: Molded lettering, as indicated for each service.
- B. Polymer Concrete Handholes and Boxes with Polymer Concrete Cover: Molded of sand and aggregate, bound together with a polymer resin, and reinforced with steel or fiberglass or a combination of the two.

2.5 SOURCE QUALITY CONTROL

- A. Test and inspect precast concrete utility structures according to ASTM C 1037.
- B. Nonconcrete Handhole and Pull-Box Prototype Test: Test prototypes of manholes and boxes for compliance with SCTE 77. Strength tests shall be for specified tier ratings of products supplied.
 - 1. Tests of materials shall be performed by an independent testing agency.
 - 2. Strength tests of complete boxes and covers shall be by either an independent testing agency or manufacturer. A qualified registered professional engineer shall certify tests by manufacturer.
 - 3. Testing machine pressure gages shall have current calibration certification, complying with ISO 9000 and ISO 10012, and traceable to NIST standards.

PART 3 - EXECUTION

3.1 GENERAL REQUIREMENTS

- A. The layout of duct banks shall be generally parallel and perpendicular to property and building lines.
- B. All conduit and ducts must be terminated with bell ends at the manhole, facility or other termination point. A nylon pull string will be installed and tied off in each conduit.
- C. All underground conduits and ducts, rigid or PVC, installed shall be added in-multiples of two.
- D. All underground conduits, duct banks and raceways shall be encased in steel reinforced, concrete (3500 psi minimum).
- E. Additional reinforcement shall be used when crossing roadways.
- F. All communications ducts shall be a minimum of twelve (12) inches from power duct banks or cables. All communications ducts shall also be a minimum of twenty four (24) inches from steam pipes and condensate lines if crossing perpendicular. When communication ducts run parallel to steam lines a minimum of a six (6) foot separation is required to avoid conduction of heat. All other duct separations must comply with the National Electric Code.

- G. Rigid steel conduit, encased in reinforced concrete, shall be used in any location subject to unbalanced pressure, such as under slabs, roadways, driveways, or foundations.
- H. All necessary precautions shall be taken by the contractor during construction to prevent the lodging of dirt, plaster or trash in all conduit, tubing, fittings and boxes. All conduits in floors, concrete or below grade shall be swabbed free of debris and moisture before wires are pulled.

3.2 PREPARATION

- A. Coordinate layout and installation of ducts, manholes, handholes, and boxes with final arrangement of other utilities, site grading, and surface features as determined in the field. Notify Architect if there is a conflict between areas of excavation and existing structures or archaeological sites to remain.
- B. Coordinate elevations of ducts and duct-bank entrances into manholes, handholes, and boxes with final locations and profiles of ducts and duct banks, as determined by coordination with other utilities, underground obstructions, and surface features. Revise locations and elevations as required to suit field conditions and to ensure that duct runs drain to manholes and handholes, and as approved by Architect.

3.3 UNDERGROUND DUCT APPLICATION

- A. Ducts for Electrical Feeders 600 V and Less: RNC, NEMA Type EPC-40 PVC, in concrete-encased duct bank unless otherwise indicated.
- B. Ducts for Electrical Branch Circuits: RNC, NEMA Type EPC-40 PVC, concrete-encased unless otherwise indicated.
- C. Underground Ducts 600V and less Crossing Driveways and Roadways: RNC, NEMA Type EPC-40-PVC, encased in reinforced concrete.
- D. Ducts for Electrical Feeders 600 V and Less below building slab: RNC, NEMA Type EPC-40-PVC, encased in reinforced concrete or Rigid Steel Conduit.

3.4 EARTHWORK

- A. Excavation and Backfill: Comply with Division 31 but do not use heavy-duty, hydraulic-operated, compaction equipment.
- B. Restore surface features at areas disturbed by excavation, and re-establish original grades unless otherwise indicated. Replace removed sod immediately after backfilling is completed.
- C. Restore areas disturbed by trenching, storing of dirt, cable laying, and other work. Restore vegetation and include necessary topsoiling, fertilizing, liming, seeding, sodding, sprigging, and mulching. Comply with Division 32.
- D. Cut and patch existing pavement in the path of underground ducts and utility structures according to the "Cutting and Patching" requirements in Division 01.

3.5 DUCT INSTALLATION

- A. Install ducts according to NEMA TCB 2.
- B. Slope: Pitch ducts a minimum slope of 1:300 down toward manholes and handholes and away from buildings and equipment. Slope ducts from a high point in runs between two manholes, to drain in both directions.
- C. Curves and Bends: Use 5-degree angle couplings for small changes in direction. Use manufactured long sweep bends with a minimum radius of 48 inches vertically and 25 feet, horizontally, at other locations unless otherwise indicated.
- D. Joints: Use solvent-cemented joints in ducts and fittings and make watertight according to manufacturer's written instructions. Stagger couplings so those of adjacent ducts do not lie in same plane.
- E. Installation Adjacent to High-Temperature Steam Lines: Where duct banks are installed parallel to underground steam lines, perform calculations showing the duct bank will not be subject to

environmental temperatures above 40 deg C. Where environmental temperatures are calculated to rise above 40 deg C, and anywhere the duct bank crosses above an underground steam line, install insulation blankets listed for direct burial to isolate the duct bank from the steam line.

- F. Sealing: Provide temporary closure at terminations of ducts that have cables pulled. Seal spare ducts at terminations. Use sealing compound and plugs to withstand at least 15-psig (1.03-MPa) hydrostatic pressure.
- G. Pulling Cord: Install 100-lbf test nylon cord in empty ducts.
- H. Concrete-Encased Ducts: Support ducts on duct separators.
 - 1. Excavate trench bottom to provide firm and uniform support for duct bank. Prepare trench bottoms as specified in Division 31 for pipes less than 6 inches in nominal diameter.
 - 2. Width: Excavate trench 3 inches wider than duct bank on each side.
 - 3. Depth: Install top of duct bank at least 24 inches below finished grade in areas not subject to deliberate traffic, and at least 30 inches below finished grade in deliberate traffic paths for vehicles unless otherwise indicated.
 - 4. Support ducts on duct separators coordinated with duct size, duct spacing, and outdoor temperature.
 - 5. Separator Installation: Space separators close enough to prevent sagging and deforming of ducts, with not less than four spacers per 20 feet of duct. Secure separators to earth and to ducts to prevent floating during concreting. Stagger separators approximately 6 inches between tiers. Tie entire assembly together using fabric straps; do not use tie wires or reinforcing steel that may form conductive or magnetic loops around ducts or duct groups.
 - 6. Minimum Space between Ducts: 3 inches between ducts and exterior envelope wall, 2 inches between ducts for like services, and 4 inches between power and signal ducts.
 - 7. Use manufactured duct long sweep fittings for stub-ups at poles and equipment, at building entrances through floor. All changes of direction in duct run shall use factory or field fabricated swaps with 10' minimum radius unless otherwise indicated. Extend concrete encasement throughout length of elbow.
 - 8. Reinforcement: Reinforce concrete-encased duct banks for their entire length. Arrange reinforcing rods and ties without forming conductive or magnetic loops around ducts or duct groups.
 - 9. Forms: Use walls of trench to form side walls of duct bank where soil is self-supporting and concrete envelope can be poured without soil inclusions; otherwise, use forms.
 - 10. Concrete Cover: Install a minimum of 2 inches of concrete cover at top and sides, and a minimum of 6 inches on bottom of duct bank.
 - 11. Concreting Sequence: Pour each run of envelope between manholes or other terminations in one continuous operation.
 - a. Start at one end and finish at the other, allowing for expansion and contraction of ducts as their temperature changes during and after the pour. Use expansion fittings installed according to manufacturer's written recommendations, or use other specific measures to prevent expansion-contraction damage.
 - b. If more than one pour is necessary, terminate each pour in a vertical plane and install 3/4-inch (15-mm) reinforcing-rod dowels extending a minimum of 18 inches into concrete on both sides of joint near corners of envelope.
 - 12. Pouring Concrete: Concrete shall be dyed red for power and yellow for communications. Comply with requirements in "Concrete Placement" Article in Section 033000 "Cast-in-Place Concrete." Place concrete carefully during pours to prevent voids under and between conduits and at exterior surface of envelope. Do not allow a heavy mass of concrete to fall directly onto ducts. Allow concrete to flow to center of bank and rise up in middle, uniformly filling all open spaces. Do not use power-driven agitating equipment unless specifically designed for duct-bank application.
- I. Direct-Buried Duct Banks:

1. Excavate trench bottom to provide firm and uniform support for duct bank. Comply with requirements in Division 31 for preparation of trench bottoms for pipes less than 6 inches (150 mm) in nominal diameter.
2. Stagger spacers approximately 6 inches between tiers.
3. Depth: Install top of duct bank at least 36 inches below finished grade unless otherwise indicated.
4. Set elevation of bottom of duct bank below frost line.
5. Install ducts with a minimum of 3 inches between ducts for like services and 6 inches between power and signal ducts.
6. Elbows: Install manufactured duct elbows for stub-ups at poles and equipment, at building entrances through floor, and at changes of direction in duct run unless otherwise indicated. Encase elbows for stub-up ducts throughout length of elbow.
7. Install manufactured rigid steel conduit elbows for stub-ups at poles and equipment, at building entrances through floor, and at changes of direction in duct run.
 - a. Couple steel conduits to ducts with adapters designed for this purpose, and encase coupling with 3 inches of concrete.
 - b. For equipment mounted on outdoor concrete bases, extend steel conduit horizontally a minimum of 60 inches from edge of equipment pad or foundation. Install insulated grounding bushings on terminations at equipment.
8. After installing first tier of ducts, backfill and compact. Start at tie-in point and work toward end of duct run, leaving ducts at end of run free to move with expansion and contraction as temperature changes during this process. Repeat procedure after placing each tier. After placing last tier, hand place backfill to 4 inches over ducts and hand tamp. Firmly tamp backfill around ducts to provide maximum supporting strength. Use hand tamper only. After placing controlled backfill over final tier, make final duct connections at end of run and complete backfilling with normal compaction. Comply with requirements in Division 31 for installation of backfill materials.
 - a. Place minimum 3 inches (75 mm) of sand as a bed for duct bank. Place sand to a minimum of 6 inches above top level of duct bank.
 - b. Place minimum 6 inches of engineered fill above concrete encasement of duct bank.
9. Warning Tape: Bury warning tape approximately 12 inches above all concrete-encased ducts and duct banks. Align tape parallel to and within 3 inches of centerline of duct bank. Provide an additional warning tape for each 12-inch increment of duct-bank width over a nominal 18 inches. Space additional tapes 12 inches apart, horizontally.

3.6 INSTALLATION OF HANDHOLES AND BOXES OTHER THAN PRECAST CONCRETE

- A. Install hand-holes and boxes level and plumb and with orientation and depth coordinated with connecting ducts, to minimize bends and deflections required for proper entrances. Use box extension if required to match depths of ducts, and seal joint between box and extension as recommended by manufacturer.
- B. Unless otherwise indicated, support units on a level bed of crushed stone or gravel, graded from 1/2-inch (12.5-mm) sieve to No. 4 (4.75-mm) sieve and compacted to same density as adjacent undisturbed earth.
- C. Elevation: In paved areas and trafficways, set cover flush with finished grade. Set covers of other handholes 1 inch (25 mm) above finished grade.
- D. Field cut openings for ducts and conduits according to enclosure manufacturer's written instructions. Cut wall of enclosure with a tool designed for material to be cut. Size holes for terminating fittings to be used, and seal around penetrations after fittings are installed.
- E. Form and pour a concrete ring encircling, and in contact with, enclosure and with top surface screeded to top of box cover frame. Bottom of ring shall rest on compacted earth.
 1. Concrete: 3000 psi (20 kPa), 28-day strength, complying with Section 033000 "Cast-in-Place Concrete," with a troweled finish.
 2. Dimensions as shown on drawings.

3.7 DUCT-BANK INSPECTION

- A. All communication duct runs shall be inspected and approved by Owner Engineering staff prior to pouring of concrete. At least twenty four (24) hour prior notice will be given to Owner that a pour will be taking place. Failure to obtain inspection and approval in writing will result in removal of ductbank.
- B. All primary power duct runs shall be inspected and approved by Owner Engineering staff prior to pouring of concrete. At least twenty four (24) hour prior notice will be given to Owner that a pour will be taking place. Failure to obtain inspection and approval in writing will result in removal of ductbank.

3.8 DRAINAGE OF DUCT-BANKS

- A. Duct-banks shall be pitched to drain toward manholes. All conduit, tubing, raceways, ducts and duct banks shall be installed in such manner to insure against collection of trapped condensation. Raceway runs shall be arranged to be void of traps.
- B. When conduits pass through exterior concrete walls of any facility, the entrance shall be watertight. Wall sleeves at entrance points must be sized to provide a minimum of 1/2-inch clearance around the conduit to allow for proper sealing of the penetration.
- C. All conduits shall have watertight connections and be sloped so they drain away from the building entrance. All empty conduits are to be sealed with the proper materials to prevent water drainage into the building.

3.9 MARKINGS

- A. Utility markers shall identify ALL conduit and duct-bank routes. The type of marker and manufacturer shall be obtained from Owner Project Management. Utility markers shall conform to Owner Project Management's Legend for Utility Markers. Prior approval and coordination with Owner Manager of Utilities, and other concerned parties is necessary when the situation requires any modification to the conduit system.
- B. Damages incurred to any conduit are the responsibility of the party involved. All damages shall be reported to Owner Manager of Utilities immediately.

3.10 GROUNDING

- A. Ground underground ducts and utility structures with minimum of two (2) 3/4" x 10' ground rods.

3.11 FIELD QUALITY CONTROL

- A. Perform the following tests and inspections and prepare test reports:
 - 1. Demonstrate capability and compliance with requirements on completion of installation of underground ducts and utility structures.
 - 2. Pull solid aluminum or wood test mandrel through duct to prove joint integrity and adequate bend radii, and test for out-of-round duct. Provide a minimum 6-inch- (150-mm-) long mandrel equal to 80 percent fill of duct. If obstructions are indicated, remove obstructions and retest.
 - 3. Test manhole grounding to ensure electrical continuity of grounding and bonding connections. Measure and report ground resistance as specified in Section 260526 "Grounding and Bonding for Electrical Systems."
- B. Correct deficiencies and retest as specified above to demonstrate compliance.

3.12 CLEANING

- A. Pull leather-washer-type duct cleaner, with graduated washer sizes, through full length of ducts. Follow with rubber duct swab for final cleaning and to assist in spreading lubricant throughout ducts.
- B. Clean internal surfaces of manholes, including sump. Remove foreign material.

END OF SECTION

DIVISION 26 – ELECTRICAL

SECTION 260553 - IDENTIFICATIONS FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General, Special and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.
- B. The Contractor is directed to examine each and every section of these specifications, all drawings relating to the Contract Documents, any and all Addenda, etc., for work described elsewhere that may relate to the provision of the work described herein. Materials and performance requirements are specified elsewhere herein that relate to these systems.
- C. Each Electrical Contractor's attention is directed to Section 260501 - General Provisions, Electrical, and all other Contract Documents as they apply to his work.

1.2 SUMMARY

- A. Section Includes:
 - 1. Identification for raceways.
 - 2. Identification of power and control cables.
 - 3. Identification for conductors.
 - 4. Underground-line warning tape.
 - 5. Warning labels and signs.
 - 6. Instruction signs.
 - 7. Equipment identification labels.
 - 8. Miscellaneous identification products.

1.3 DEFINITIONS AND ABBREVIATIONS

- A. T - Transformer
- B. SWGR – Switchgear (New).
- C. SWBD – Switchboard (Existing).
- D. P – Panel. Electrical distribution panels with manually operated circuit breakers which feed other distribution panels or directly to loads. These are generally the last distribution panel before the load.
- E. N - Normal power system. Annotates that the associated component is part of the Normal Power distribution system and receives no backup power from the Emergency Power distribution system.
- F. BKR – Breaker. Switch which interrupts or establishes power flow to its associated load.
- G. DISC - Disconnect Switch. Manually operated knife switch which interrupts or establishes power flow to its associated load.

1.4 ACTION SUBMITTALS

- A. Product Data: For each electrical identification product indicated.
- B. Samples: For each type of label and sign to illustrate size, colors, lettering style, mounting provisions, and graphic features of identification products.
- C. Identification Schedule: An index of nomenclature of electrical equipment and system components used in identification signs and labels.

1.5 COORDINATION

- A. Coordinate identification names, abbreviations, colors, and other features with requirements in other Sections requiring identification applications, Drawings, Shop Drawings, manufacturer's wiring diagrams, and the Operation and Maintenance Manual; and with those required by codes, standards, and 29 CFR 1910.145. Use consistent designations throughout Project.
- B. Coordinate installation of identifying devices with completion of covering and painting of surfaces where devices are to be applied.
- C. Coordinate installation of identifying devices with location of access panels and doors.
- D. Install identifying devices before installing acoustical ceilings and similar concealment.

PART 2 - PRODUCTS

2.1 FLOOR MARKING TAPE

- A. 2-inch wide, 5-mil pressure-sensitive vinyl tape, with black and white stripes and clear vinyl overlay.

2.2 WARNING LABELS AND SIGNS

- A. Comply with NFPA 70 and 29 CFR 1910.145.
- B. Self-Adhesive Warning Labels: Factory-printed, multicolor, pressure-sensitive adhesive labels, configured for display on front cover, door, or other access to equipment unless otherwise indicated.
- C. Baked-Enamel Warning Signs:
 - 1. Preprinted aluminum signs, punched or drilled for fasteners, with colors, legend, and size required for application.
 - 2. 1/4-inch grommets in corners for mounting.
 - 3. Nominal size, 7 by 10 inches.
- D. Metal-Backed, Butyrate Warning Signs:
 - 1. Weather-resistant, nonfading, preprinted, cellulose-acetate butyrate signs with 0.0396-inch galvanized-steel backing; and with colors, legend, and size required for application.
 - 2. 1/4-inch grommets in corners for mounting.
 - 3. Nominal size, 10 by 14 inches.
- E. Warning label and sign shall include, but are not limited to, the following legends:
 - 1. Workspace Clearance Warning: "WARNING - OSHA REGULATION - AREA IN FRONT OF ELECTRICAL EQUIPMENT MUST BE KEPT CLEAR FOR 36 INCHES"
- F. Provide warning signs for the enclosures of electrical equipment including pad-mounted transformers, pad-mounted switches, and switchgear having a nominal rating exceeding 600 volts.
 - 1. When the enclosure integrity of such equipment is specified to be in accordance with IEEE C57.12.28 or IEEE C57.12.29, such as for pad-mounted transformers, provide self-adhesive warning signs on the outside of the high voltage compartment door(s). Sign shall be a decal and shall have nominal dimensions of 7 by 10 inches with the legend "DANGER HIGH VOLTAGE" printed in two lines of nominal 2 inch high letters. The word "DANGER" shall be in white letters on a red background and the words "HIGH VOLTAGE" shall be in black letters on a white background. Decal shall be Panduit No. PPSO710D72 or approved equal.
 - 2. When such equipment is guarded by a fence, mount signs on the fence. Provide metal signs having nominal dimensions of 14 by 10 inches with the legend "DANGER HIGH VOLTAGE KEEP OUT" printed in three lines of nominal 3 inch high white letters on a red and black field. Sign shall be Panduit No. PASO710D72 or approved equal.

2.3 INSTRUCTION SIGNS

- A. Engraved, laminated acrylic or melamine plastic, minimum 1/16 inch thick for signs up to 20 sq. inches and 1/8 inch thick for larger sizes.
 - 1. Engraved legend with black letters on white face.
 - 2. Punched or drilled for mechanical fasteners.
 - 3. Framed with mitered acrylic molding and arranged for attachment at applicable equipment.
- B. Adhesive Film Label: Machine printed, in black, by thermal transfer or equivalent process. Minimum letter height shall be 3/8 inch.
- C. Adhesive Film Label with Clear Protective Overlay: Machine printed, in black, by thermal transfer or equivalent process. Minimum letter height shall be 3/8 inch. Overlay shall provide a weatherproof and UV-resistant seal for label.

2.4 EQUIPMENT IDENTIFICATION LABELS

- A. Self-Adhesive, Engraved, Laminated Acrylic or Melamine Label: Adhesive backed, with white letters on a dark-gray background. Minimum letter height shall be 3/8 inch (10 mm).
- B. Engraved, Laminated Acrylic or Melamine Label: Punched or drilled for screw mounting. White letters on a dark-gray background. Minimum letter height shall be 3/8 inch (10 mm).
- C. Retain paragraph below to specify type of label for identifying outdoor equipment if specified in "Identification Schedule" Article.
- D. Stenciled Legend: In non-fading, waterproof, black ink or paint. Minimum letter height shall be 1 inch.

2.5 CABLE TIES

- A. UV-Stabilized Cable Ties: Fungus inert, designed for continuous exposure to exterior sunlight, self extinguishing, one piece, self locking, Type 6/6 nylon.
 - 1. Minimum Width: 3/16 inch.
 - 2. Tensile Strength at 73 deg F (23 deg C), According to ASTM D 638: 12,000 psi.
 - 3. Temperature Range: Minus 40 to plus 185 deg F (Minus 40 to plus 85 deg C).
 - 4. Color: Clear
- B. Plenum-Rated Cable Ties: Self extinguishing, UV stabilized, one piece, self locking.
 - 1. Minimum Width: 3/16 inch (5 mm).
 - 2. Tensile Strength at 73 deg F (23 deg C), According to ASTM D 638: 7000 psi.
 - 3. UL 94 Flame Rating: 94V-0.
 - 4. Temperature Range: Minus 50 to plus 284 deg F (Minus 46 to plus 140 deg C).
 - 5. Color: Clear

2.6 MISCELLANEOUS IDENTIFICATION PRODUCTS

- A. Paint: Comply with requirements in Division 09 painting Sections for paint materials and application requirements. Select paint system applicable for surface material and location (exterior or interior).
- B. Fasteners for Labels and Signs: Self-tapping, stainless-steel screws or stainless-steel machine screws with nuts and flat and lock washers.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Verify identity of each item before installing identification products.
- B. Location: Install identification materials and devices at locations for most convenient viewing without interference with operation and maintenance of equipment.
- C. Apply identification devices to surfaces that require finish after completing finish work.

- D. Self-Adhesive Identification Products: Clean surfaces before application, using materials and methods recommended by manufacturer of identification device.
- E. Attach signs and plastic labels that are not self-adhesive type with mechanical fasteners appropriate to the location and substrate.
- F. Cable Ties: For attaching tags.
 - 1. Indoors: Plenum rated.
 - 2. Outdoors: UV-stabilized nylon.
- G. Painted Identification: Comply with requirements in Division 09 painting Sections for surface preparation and paint application.
- H. Equipment, disconnect switches, switchgear, switchboards, panelboards, transformers, motor starters, variable frequency drives, special device plates, and similar materials shall be clearly marked as to their function and use. Markings shall be applied neatly and conspicuously to the front of each item of equipment with 1/2" black lamacoid plate (or equivalent) with white letters 1/4" high unless otherwise specified.
- I. PANELBOARD DIRECTORIES
 - 1. The Contractor shall provide clearly legible typewritten directories in each electrical panel indicating the area, item of equipment, etc. controlled by each switch, breaker, fuse, etc. These directories are to be inserted into plastic cardholders on back door in each panel. Descriptions shall be provided by the Owner/City. Coordinate with City prior to providing final typewritten directories.
 - 2. All existing panels shall also be provided with new updated typewritten directories.
 - 3. Provide electronic Excel files of all directories to owner as part of Close-out Documentation.
 - 4. Panel Schedules and circuit numbers on Record Drawings shall match.
- J. All electrical distribution equipment shall be provided with a black lamacoid plastic plate with 1/2" white letters for panel designation and 1/4" white letters showing voltage and feeder information. This includes branch circuit panelboards, switchboards, switchgear, disconnect switches, transformers, motor starters, variable frequency drives and lighting control panels, Branch circuit switches shall be designated as to function. Electrical distribution equipment labels shall indicate the source they are fed from, and the circuit number at that source. Clearly indicate the exact label legend to be furnished with each panelboard and switchgear on the shop drawings for each item of equipment prior to submission of shop drawings. Refer to drawings for further details.
- K. Lamacoid plates shall be located at center of top of trim for branch circuit panels, switch gear, and centered at side for branch circuit switches. Fasten with self-tapping stainless steel screws or other approved method.
- L. All junction boxes utilized for life-safety branch emergency power circuits, connections, devices, etc. shall have the cover painted blue. Mark over paint with panel and circuit number.
- M. All concealed junction boxes utilized for fire alarm circuits, connections, devices, etc. shall have the cover painted red. Mark over paint with stenciled letters "FA".
- N. All new and existing receptacle cover plates shall be marked with their panel and circuit number(s) with clear, machine printed adhesive labels with 1/4" black lettering.
- O. All identifications shall be consistent with the owner's standard practices, especially within existing facilities. Where the requirements here-in are in conflict with such standard practices, the contractor shall notify the engineer in writing prior to ordering any material for clarification.
- P. Identification shall consist of all UPPER CASE LETTERS.
- Q. Location: Install identification materials and devices at locations for most convenient viewing without interference with operation and maintenance of equipment.

- R. Apply identification devices to surfaces that require finish after completing finish work.
- S. Self-Adhesive Identification Products: Clean surfaces before application, using materials and methods recommended by manufacturer of identification devices.
- T. Attach signs and plastic labels that are not self-adhesive type with mechanical fasteners appropriate to the location and substrate.
- U. Underground-Line Warning Tape: During backfilling of trenches install continuous underground-line warning tape directly above line at 6 to 8 inches below finished grade. Use multiple tapes where width of multiple lines installed in a common trench or concrete envelope exceeds 16 inches overall.
- V. Fire alarm system: Install a nameplate on the fire alarm panel to indicate the panelboard and circuit number supplying the fire alarm system.
- W. Concealed Raceways, Duct Banks, More Than 600 V, within Buildings: Tape and stencil 4-inch wide black stripes on 10-inch centers over orange background that extends full length of raceway or duct and is 12 inches wide. Stencil legend "DANGER CONCEALED HIGH VOLTAGE WIRING" with 3-inch high black letters on 20-inch centers. Stop stripes at legends. Apply to the following finished surfaces:
 - 1. Floor surface directly above conduits running beneath and within 12 inches (300 mm) of a floor that is in contact with earth or is framed above unexcavated space.
 - 2. Wall surfaces directly external to raceways concealed within wall.
 - 3. Accessible surfaces of concrete envelope around raceways in vertical shafts, exposed in the building, or concealed above suspended ceilings.
- X. Accessible Raceways and Cables within Buildings: Identify the covers of each junction and pull box of the following systems with self-adhesive vinyl labels with the wiring system legend and system voltage. System legends shall be as follows:
 - 1. Power
- Y. Install instructional sign including the color-code for grounded and ungrounded conductors using adhesive-film-type labels.
- Z. Locations of Underground Lines: Identify with underground-line warning tape for power, lighting, communication, and control wiring and optical fiber cable.
- AA. Workspace Indication: Install floor marking tape to show working clearances in the direction of access to live parts. Workspace shall be as required by NFPA 70 and 29 CFR 1926.403 unless otherwise indicated. Do not install at flush-mounted panelboards and similar equipment in finished spaces.
- BB. Warning Labels for Indoor Cabinets, Boxes, and Enclosures for Power and Lighting: Self-adhesive warning labels
 - 1. Comply with 29 CFR 1910.145.
 - 2. Identify system voltage with black letters on an orange background.
 - 3. Apply to exterior of door, cover, or other access.
 - 4. For equipment with multiple power or control sources, apply to door or cover of equipment including, but not limited to, the following:
 - a. Controls with external control power connections.
- CC. Operating Instruction Signs: Install instruction signs to facilitate proper operation and maintenance of electrical systems and items to which they connect. Install instruction signs with approved legend where instructions are needed for system or equipment operation.
- DD. Emergency Operating Instruction Signs: Install instruction signs with white legend on a red background with minimum 3/8-inch high letters for emergency instructions at equipment used for power transfer and load shedding.
- EE. Equipment Identification Labels: On each unit of equipment, install unique designation label that is consistent with wiring diagrams, schedules, and the Operation and Maintenance Manual. Apply labels to

disconnect switches and protection equipment, central or master units, control panels, control stations, terminal cabinets, and racks of each system. Systems include power, lighting, control, communication, signal, monitoring, and alarm systems unless equipment is provided with its own identification.

FF. Labeling Instructions:

1. Indoor Equipment: Engraved, laminated acrylic or melamine label. Unless otherwise indicated, provide a single line of text with 1/2-inch high letters on 1-1/2-inch high label; where two lines of text are required, use labels 2 inches high.
2. Outdoor Equipment: Engraved, laminated acrylic or melamine label.
3. Elevated Components: Increase sizes of labels and letters to those appropriate for viewing from the floor.
4. Unless provided with self-adhesive means of attachment, fasten labels with appropriate mechanical fasteners that do not change the NEMA or NRTL rating of the enclosure.

END OF SECTION

DIVISION 26 – ELECTRICAL

SECTION 260573 - ELECTRICAL STUDIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General, Special and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.
- B. The Contractor is directed to examine each and every section of these specifications, all drawings relating to the Contract Documents, any and all Addenda, etc., for work described elsewhere that may relate to the provision of the work described herein. Materials and performance requirements are specified elsewhere herein that relate to these systems.
- C. Each Electrical Contractor's attention is directed to Section 260501 - General Provisions, Electrical, and all other Contract Documents as they apply to his work.

1.2 SUMMARY

- A. Provide a short-circuit, component protection, arc-flash hazard analysis, and protective device coordination study for the electrical distribution system beginning with all power sources and ending with the lowest level power, lighting and receptacle panels, and motor control equipment.
- B. This Section includes computer-based, fault-current, arc-flash and overcurrent protective device coordination studies. Hand calculations are not acceptable. Protective devices shall be set based on results of the protective device coordination study.
- C. Electrical Studies shall be performed by the Low-Voltage Switchboard manufacturer. All Electrical Studies required by this specification shall be completed within five (5) weeks from award of project. The Electrical Contractor shall provide all required data to Low-Voltage Switchboard manufacturer within one (1) week and the manufacturer will have four (4) weeks to complete the studies.
- D. A licensed professional engineer employee of the Low-Voltage Switchboard manufacturer shall provide electrical power system studies for the project using the latest version of one of the approved software packages. The software model files shall be submitted with the report. The analysis shall follow the latest IEEE 1584 guidelines. An example report will be provided by the Owner upon request.
- E. Studies specified herein must be submitted and approved prior to release of any affected equipment. Revisions to equipment or devices necessary to meet study recommendations shall be at the Manufacturer's expense.
- F. All adjustments and settings recommended by these studies shall be made prior to any testing.
- G. The analysis shall be submitted to the engineer of record prior to receiving final approval of the distribution equipment shop drawings and/or prior to release of equipment drawings for manufacturing.

1.3 PURPOSE

- A. The study shall calculate the worst case available short circuit current at each point in the electrical distribution system considering all power sources under all permissible system operating and switching modes. The study shall be performed in accordance with Part 3 of this specification. The overcurrent protective devices shall have an interrupting and/or withstand rating equal to or greater than the available short circuit current at the applicable time band (1/2, 5, or 8 cycle) at the point of application. Discrepancies shall be noted and called to the attention of the Architect/Engineer.
- B. The overcurrent protective devices shall be analyzed for adequate short circuit rating. This analysis shall identify any potential insufficient equipment ratings of existing equipment based on actual available utility values.

- C. The study shall also include an arc flash hazard analysis for all electrical equipment. The analysis shall determine the flash protection boundary, incident energy, and required level of Personal Protective Equipment (PPE) for workers at the electrical equipment. The arc flash protection boundary and incident energy shall be determined based upon a working distance as defined in per IEEE 1584, based on system voltages. The electrical distribution equipment shall be field marked with this information in accordance with NFPA 70E.
- D. The above study shall use equipment designation (labeling) that is consistent with the electrical system diagrams. Equipment shall be readily identifiable without the use of a cross reference list.

1.4 SUBMITTALS

- A. Product Data: Computer software program to be used for studies.
- B. Product Certificates: For coordination-study and fault-current-study computer software programs, certifying compliance with IEEE 399.
- C. Qualification Data: For coordination-study specialist.
- D. Other Action Submittals:
 - 1. The following submittals shall be made after the approval process for system protective devices has been completed. Submittals shall be in digital form.
 - a. Coordination-study input data, including completed computer program input data sheets.
 - b. Study and Equipment Evaluation Reports.
 - c. Coordination-Study Report.
 - d. Short Circuit Study and Coordination Study including all input data.
 - e. Study recommendations for device settings, fuse types/ sizes and Equipment Evaluation findings.
 - f. Report shall include any identified recommendations for improvements or suggestions for correction of deficiencies for consideration by the Architect/Engineer.
 - g. Arc-Flash Hazard Calculations and list of data for Labels, including any recommendations to reduce any PPE Category 4 or higher hazard level to a PPE Category 3 or lower hazard level.
 - 2. The results of the study shall be summarized in report form, for review and approval by the Architect/Engineer.
 - 3. The results of all studies shall include the following:
 - a. Descriptions, purpose, basis, and scope of study.
 - b. Fault current calculations including definition of terms and guide for interpretation of computer printout.
 - c. Tabulations of protective device and equipment ratings versus maximum calculated short circuit duties, and commentary regarding same.
 - d. Flash hazard analysis report for newly installed and directly impacted existing electrical equipment. Based on the worst case resulting in Greatest Personnel Hazard.
 - e. Time versus current curves with tabulations of overcurrent protective device settings and selective coordination analysis and commentary regarding same.
 - f. The above studies shall be submitted to the Architect/Engineer for review and comment, before any labels are printed.
 - g. If power company review and/or approval of device settings or fuse types/sizes is required, appropriate data shall be submitted to the power company for review and/or approval. The results of the power company review and /or approval shall be forwarded to the Architect/Engineer and included in the study report.
- E. The studies must bear the signature/seal of the Professional Electrical Engineer in the state where the project is located.

1.5 QUALITY ASSURANCE

- A. Studies shall use computer programs that are distributed nationally and are in wide use. Software algorithms shall comply with requirements of standards and guides specified in this Section. Manual calculations are not acceptable.
 - B. Coordination-Study Specialist Qualifications: An entity experienced in the application of computer software used for studies, having performed successful studies of similar magnitude on electrical distribution systems using similar devices.
 - 1. Professional engineer, licensed in the state where Project is located, shall be responsible for the study. All elements of the study shall be performed under the direct supervision and control of engineer.
 - C. Comply with IEEE 242 for short-circuit currents and coordination time intervals.
 - D. Comply with IEEE 399 (power system analysis) for general study procedures.
 - E. Comply with IEEE 1584 (guide for performing arc flash hazard calculations) for Arc Flash calculation procedures.
- 1.6 Commissioning
- A. This section specifies a system or a component of a system being commissioned as defined in Section 019113 Commissioning. Testing of these systems is required, in cooperation with the Owner and the Commissioning Authority. Refer to Section 019113 Commissioning for detailed commissioning requirements.

PART 2 - PRODUCTS

2.1 COMPUTER SOFTWARE DEVELOPERS

- A. Computer Software Developers: Subject to compliance with requirements, provide products by SKM Systems Analysis, Inc.

2.2 COMPUTER SOFTWARE PROGRAM REQUIREMENTS

- A. Comply with IEEE 399.
- B. Analytical features of fault-current-study computer software program shall include "mandatory," "very desirable," and "desirable" features as listed in IEEE 399.
- C. Computer software program shall be capable of plotting and diagramming time-current-characteristic curves as part of its output. Computer software program shall report device settings and ratings of all overcurrent protective devices and shall demonstrate selective coordination by computer-generated, time-current coordination plots.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine Project overcurrent protective device submittals for compliance with electrical distribution system coordination requirements and other conditions affecting performance. Discrepancies shall be noted and called to the attention of Architect/Engineer.

3.2 POWER SYSTEM DATA

- A. Gather and tabulate the following input data to support coordination study:
 - 1. Product Data for overcurrent protective devices specified in other Division 26 Sections and involved in overcurrent protective device coordination studies. Use equipment designation tags that are consistent with electrical distribution system diagrams, overcurrent protective device submittals, input and output data, and recommended device settings.
 - 2. Impedance of utility service entrance.

3. Electrical Distribution System Diagram: In hard-copy and electronic-copy formats, showing the following:
 - a. Circuit-breaker and fuse-current ratings and types.
 - b. Relays and associated power and current transformer ratings and ratios.
 - c. Transformer kilovolt amperes, primary and secondary voltages, connection type, impedance, and X/R ratios.
 - d. Generator kilovolt amperes, size, voltage, and source impedance.
 - e. Cables: Indicate conduit material, sizes of conductors, conductor material, insulation, and length.
 - f. Busway ampacity and impedance.
 - g. Motor horsepower and code letter designation according to NEMA MG 1.
 4. Data sheets to supplement electrical distribution system diagram, cross-referenced with tag numbers on diagram, showing the following:
 - a. Special load considerations, including starting inrush currents and frequent starting and stopping.
 - b. Transformer characteristics, including primary protective device, magnetic inrush current, and overload capability.
 - c. Motor full-load current, locked rotor current, service factor, starting time, type of start, and thermal-damage curve.
 - d. Generator thermal-damage curve.
 - e. Ratings, types, and settings of utility company's overcurrent protective devices.
 - f. Special overcurrent protective device settings or types stipulated by utility company.
 - g. Time-current-characteristic curves of devices indicated to be coordinated.
 - h. Manufacturer, frame size, interrupting rating in amperes rms symmetrical, ampere or current sensor rating, long-time adjustment range, short-time adjustment range, and instantaneous adjustment range for circuit breakers.
 - i. Manufacturer and type, ampere-tap adjustment range, time-delay adjustment range, instantaneous attachment adjustment range, and current transformer ratio for overcurrent relays.
 - j. Panelboards, switchboards, motor-control center ampacity, and interrupting rating in amperes rms symmetrical.
- B. Data shall be obtained for the power sources (campus 12 kV system and generators), impedance components (transformers, cables and busway), overcurrent protective devices (fuses, circuit breakers and relays) and other relevant equipment such as automatic transfer switches. Cable data (length, quantity per phase, size and type) shall be provided by the electrical contractor. Assumptions should only be used when the actual data is not available and the assumptions should be clearly listed in the report. Assumptions shall be kept to a minimum.
- C. A one line diagram shall be provided as part of the analysis and shall clearly identify individual equipment buses, bus numbers used in the analysis, cable information (length, quantity per phase, size and type), overcurrent device information (manufacturer, type and size), transformers, motors, transfer switches, generators, etc.
- D. The one line and analysis shall use a numbering scheme where each bus begins with a three digit number followed by a description (e.g., 102 MDPA or 103 ELEV DISC) and each connected circuit breaker or fuse shall have a corresponding designation (e.g., 102-1 MAIN CB, 102-2 ELEVATOR FDR or 103-1 ELEV DISC CB). An example one line will be provided by the Owner upon request.
- 3.3 FAULT-CURRENT STUDY
- A. Calculate the maximum available short-circuit current in amperes rms symmetrical at circuit-breaker positions of the electrical power distribution system. The calculation shall be for a current immediately after initiation and for a three-phase bolted short circuit at each of the following:
1. Switchgear and switchboard bus

2. Distribution panelboards
 3. Branch circuit panelboards
 4. Variable Frequency Drives
 5. Motor Control Centers
 6. Fused and non-fused disconnects
 7. Low-voltage transformers
 8. Individual circuit breakers
 9. Combination starter/disconnects
- B. Study electrical distribution system from normal and alternate emergency power sources throughout electrical distribution system for Project, using approved computer software program. Include studies of system-switching configurations and alternate operations that could result in maximum fault conditions.
- C. Calculate momentary and interrupting duties on the basis of maximum available fault current.
- D. Calculations to verify interrupting ratings of overcurrent protective devices shall comply with IEEE 241 and IEEE 242.
1. Transformers:
 - a. ANSI C57.12.10
 - b. ANSI C57.12.22
 - c. ANSI C57.12.40
 - d. IEEE C57.12.00
 - e. IEEE C57.96
 2. Low-Voltage Circuit Breakers: IEEE 1015 and IEEE C37.20.1.
 3. Low-Voltage Fuses: IEEE C37.46.
 4. Circuit Breakers: IEEE C37.13.
- E. Study Report: Show calculated X/R ratios and equipment interrupting rating (1/2-cycle) fault currents on electrical distribution system diagram.
- F. Equipment Evaluation Report:
1. For 600-V overcurrent protective devices, ensure that interrupting ratings are equal to or higher than calculated 1/2-cycle symmetrical fault current.
 2. For devices and equipment rated for asymmetrical fault current, apply multiplication factors listed in the standards to 1/2-cycle symmetrical fault current.
 3. Verify adequacy of phase conductors at maximum three-phase bolted fault currents; verify adequacy of equipment grounding conductors and grounding electrode conductors at maximum ground-fault currents. Ensure that short-circuit withstand ratings are equal to or higher than calculated 1/2-cycle symmetrical fault current.
- G. A table shall be included which lists the calculated short-circuit currents (rms symmetrical three phase), equipment short-circuit interrupting or withstand current ratings, and notes regarding the adequacy or inadequacy of the equipment at each bus.
- H. Any inadequacies shall be called to the attention of the engineer of record and recommendations made for improvements as soon as they are identified.
- ### 3.4 COORDINATION STUDY
- A. Perform coordination study using approved computer software program. Prepare a written report using results of fault-current study. Comply with IEEE 399.
1. Calculate the maximum and minimum 1/2-cycle short-circuit currents.
 2. Calculate the maximum and minimum interrupting duty (5 cycles to 2 seconds) short-circuit currents.
 3. Calculate the maximum and minimum ground-fault currents.
- B. Comply with IEEE 242 recommendations for fault currents and time intervals.

- C. Transformer Primary Overcurrent Protective Devices:
 - 1. Device shall not operate in response to the following:
 - a. Inrush current when first energized.
 - b. Self-cooled, full-load current or forced-air-cooled, full-load current, whichever is specified for that transformer.
 - c. Permissible transformer overloads according to IEEE C57.96 if required by unusual loading or emergency conditions.
 - 2. Device settings shall protect transformers according to IEEE C57.12.00, for fault currents.
 - 3. Device settings shall protect transformers according to IEEE C57.12.91, for fault currents.
 - D. Motors served by voltages more than 600 V shall be protected according to IEEE 620.
 - E. Conductor Protection: Protect cables against damage from fault currents according to ICEA P-32-382, ICEA P-45-482, and conductor melting curves in IEEE 242. Demonstrate that equipment withstands the maximum short-circuit current for a time equivalent to the tripping time of the primary relay protection or total clearing time of the fuse. To determine temperatures that damage insulation, use curves from cable manufacturers or from listed standards indicating conductor size and short-circuit current.
 - F. Coordination-Study Report: Prepare a written report indicating the following results of coordination study:
 - 1. Tabular Format of Settings Selected for Overcurrent Protective Devices:
 - a. Device tag.
 - b. Relay-current transformer ratios; and tap, time-dial, and instantaneous-pickup values.
 - c. Circuit-breaker sensor rating; and long-time, short-time, and instantaneous settings.
 - d. Fuse-current rating and type.
 - e. Ground-fault relay-pickup and time-delay settings.
 - 2. Coordination Curves: Prepared to determine settings of overcurrent protective devices to achieve selective coordination. Graphically illustrate that adequate time separation exists between devices installed in series, including power utility company's upstream devices. Prepare separate sets of curves for the switching schemes and for emergency periods where the power source is local generation. Show the following information:
 - a. Device tag.
 - b. Voltage and current ratio for curves.
 - c. Three-phase and single-phase damage points for each transformer.
 - d. No damage, melting, and clearing curves for fuses.
 - e. Cable damage curves.
 - f. Transformer inrush points.
 - g. Maximum fault-current cutoff point.
 - G. Completed data sheets for setting of overcurrent protective devices.
 - H. A table shall be included which lists the recommended settings of each circuit breaker and relay.
 - I. A sufficient number of log-log plots shall be provided to indicate the degree of system protection and coordination by displaying the time-current characteristics of series connected overcurrent devices and other pertinent system parameters.
 - J. Deficiencies in protection and/or coordination shall be called to the attention of the engineer of record and recommendations made for improvements as soon as they are identified.
 - K. The electrical engineer that performed the study shall be responsible to set the circuit breakers according to the analysis once the report has been approved by the engineer of record.
- 3.5 ARC FLASH HAZARD ANALYSIS

- A. The arc flash hazard analysis shall be performed according to the IEEE 1584 equations that are presented in NFPA70E-2004, Annex D.
- B. The analysis shall consider multiple possible utility scenarios as well as multiple system configurations where appropriate such as normal and emergency transfer switch positions and different main-tie-main configurations.
- C. The flash protection boundary and the incident energy shall be calculated at all significant locations in the electrical distribution system. This includes all switchboards, switchgear, motor-control centers, panelboards, busway and splitters.
- D. Safe working distances shall be based upon the calculated arc flash boundary considering an incident energy of 1.2 cal/cm².
- E. When appropriate, the short circuit calculations and the clearing times of the phase overcurrent devices will be retrieved from the short-circuit and coordination study model. Ground overcurrent relays should not taken into consideration when determining the clearing time when performing incident energy calculations.
- F. The short-circuit calculations and the corresponding incident energy calculations for multiple system scenarios must be compared and the greatest incident energy must be uniquely reported for each equipment locations. Calculations must be performed to represent the maximum and minimum contributions of fault current magnitude for all normal and emergency operating conditions. The minimum calculation will assume that the utility contribution is at a minimum and will assume a minimum motor contribution (all motors off). Conversely, the maximum calculation will assume a maximum contribution from the utility and will assume the maximum amount of motors to be operating. Calculations shall take into consideration the parallel operation of synchronous generators with the electric utility, where applicable.
- G. The incident energy calculations must consider the accumulation of energy over time when performing arc flash calculations on buses with multiple sources. Iterative calculations must take into account the changing current contributions, as the sources are interrupted or decremented with time. Fault contribution from motors and generators should be decremented as follows:
 - 1. Fault contribution from induction motors should not be considered beyond 3-5 cycles.
 - 2. Fault contribution from synchronous motors and generators should be decayed to match the actual decrement of each as closely as possible (e.g. contributions from permanent magnet generators will typically decay from 10 per unit to 3 per unit after 10 cycles).
- H. For each equipment location with a separately enclosed main device (where there is adequate separation between the line side terminals of the main protective device and the work location), calculations for incident energy and flash protection boundary shall include both the line and load side of the main breaker.
- I. When performing incident energy calculations on the line side of a main breaker (as required per above), the line side and load side contributions must be included in the fault calculation.
- J. Mis-coordination should be checked amongst all devices within the branch containing the immediate protective device upstream of the calculation location and the calculation should utilize the fastest device to compute the incident energy for the corresponding location.
- K. Arc Flash calculations shall be based on actual overcurrent protective device clearing time. Maximum clearing time will be capped at 2 seconds based on IEEE 1584-2002 section B.1.2. Where it is not physically possible to move outside of the flash protection boundary in less than 2 seconds during an arc flash event, a maximum clearing time based on the specific location shall be utilized.
- L. Incident energy and flash protection boundary calculations
 - 1. Arcing fault magnitude
 - 2. Protective device clearing time
 - 3. Duration of arc

4. Arc flash boundary
5. Working distance
6. Incident energy
7. Hazard Risk Category
8. Recommendation for arc flash energy reduction

M. The Arc Flash Hazard Analysis shall include recommendations for reducing Arc Flash Incident Energy (AFIE) levels and enhancing worker safety.

N. Results of the Arc Flash Hazard Analysis shall be submitted in tabular form and shall include the following information for each bus location: bus name, protective device name, bus voltage, bolted fault, arcing fault, trip/delay time, equipment type, working distance, arc flash boundary, incident energy and protective clothing category.

3.6 ARC FLASH WARNING LABELS

A. Arc flash labels shall be furnished and installed by the contractor of the Arc Flash Hazard Analysis.

B. The labels shall be 4 inches high by 6 inches wide and printed on a Brady THTEL-25-483-1-WA label type or similar. The arc flash label shall be formatted similarly to the examples shown below (Figure 1) and include the wording indicated in the table (Table 1) for each PPE category.

C. After labels will be based on recommended overcurrent device settings and will be provided after the results of the analysis have been presented to the owner and after any system changes, upgrades or modifications have been incorporated in the system.

D. The label shall include the following information, at a minimum:

1. Arc Flash Incident Energy
2. Location designation
3. Nominal voltage
4. Arc Flash protection boundary
5. Hazard risk category
6. Incident energy
7. Working distance
8. PPE category
9. PPE clothing description
10. PPE equipment description
11. Voltage
12. Glove class
13. Shock protection boundaries according to NFPA 70E
14. Analysis date
15. Building name/number
16. Equipment name and the upstream tripping device.
17. Engineering report number, revision number and issue date.

E. Labels shall be machine printed, with no field markings.

F. Arc flash labels shall be provided in the following manner and all labels shall be based on recommended overcurrent device settings. Provide one arc flash label for all electrical equipment including, but not limited to, the following:

1. For each 480 and applicable 208 volt panelboard, one arc flash label shall be provided.
2. For each 480 and applicable 208 volt distribution panelboard, one arc flash label shall be provided.
3. For each motor control center, one arc flash label shall be provided.
4. For each low-voltage switchboard, one arc flash label shall be provided.
5. For each switchgear, one flash label shall be provided.
6. For medium voltage switches and transformers, one arc flash label shall be provided.
7. For each fused or non-fused disconnect switch, one arc flash label shall be provided.
8. For each generator and automatic transfer switches, one arc flash label shall be provided.

9. For each variable frequency drives, one arc flash label shall be provided.
10. For each combination starter/disconnects, one arc flash label shall be provided.
11. For each fused or non-fused disconnect switch and individual circuit breakers, one arc flash label shall be provided.
12. For each low-voltage transformer, one arc flash label shall be provided.
13. For each company switch, one arc flash label shall be provided.

Figure 1. Example arc flash labels.

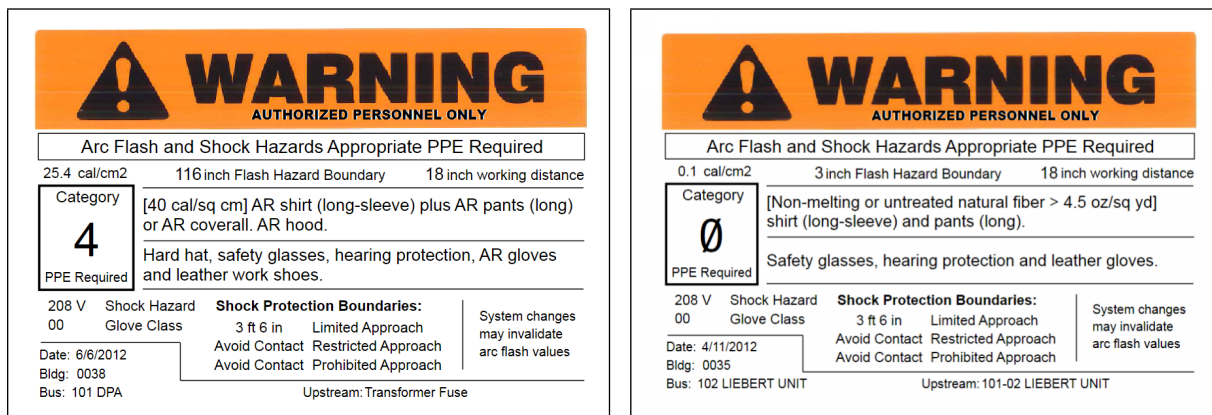


Table 1. Wording for the PPE related arc flash label fields.

Incident Energy (calories/cm ²)	PPE Category	PPE clothing	PPE equipment
0 - 1.2	0	[Non-melting or untreated natural fiber > 4.5 oz/sq yd] shirt (long-sleeve) and pants (long).	Safety glasses, hearing protection and leather gloves.
greater than 1.2 - 4	1	[4 cal/sq cm] AR shirt (long-sleeve) plus AR pants (long) or AR coverall. AR faceshield.	Hard hat, safety glasses, hearing protection, leather gloves and leather work shoes.
greater than 4 - 8	2	[8 cal/sq cm] AR shirt (long-sleeve) plus AR pants (long) or AR coverall. AR balaclava and AR face shield or AR hood.	Hard hat, safety glasses, hearing protection, leather gloves and leather work shoes.
greater than 8 - 25	3	[20 cal/sq cm] AR shirt (long-sleeve) plus AR pants (long) or AR coverall. AR hood.	Hard hat, safety glasses, hearing protection, AR gloves and leather work shoes.
greater than 25 - 40	4	[40 cal/sq cm] AR shirt (long-sleeve) plus AR pants (long) or AR coverall. AR hood.	Hard hat, safety glasses, hearing protection, AR gloves and leather work shoes.
greater than 40	X	Arc Flash Energy Exceeds the Rating of Category 4 PPE	Do not work on energized equipment

3.7 INSTALLATION/START-UP

- A. The Electrical Contractor shall install equipment and protective devices in accordance with the approved short circuit and selective coordination study.

- B. The Electrical Contractor shall field mark equipment with flash hazard analysis data as required in accordance with codes and standards.
- C. The Manufacturer's engineer shall set all adjustable overcurrent and/or timing devices in accordance with the approved study results, and then test the devices.
- D. The Manufacturer performing the study shall provide assistance to the installing Electrical Contractor during start-up of electrical system and equipment as needed.

END OF SECTION

DIVISION 26 – ELECTRICAL

SECTION 262413 – LOW-VOLTAGE SWITCHBOARD

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General, Special and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.
- B. The Contractor is directed to examine each and every section of these specifications, all drawings relating to the Contract Documents, any and all Addenda, etc., for work described elsewhere that may relate to the provision of the work described herein. Materials and performance requirements are specified elsewhere herein that relate to these systems.
- C. Each Electrical Contractor's attention is directed to Section 260501 - General Provisions, Electrical, and all other Contract Documents as they apply to his work.

1.2 SUMMARY

- A. Section Includes:
 - 1. Service entrance rated distribution Switchboards rated 600 V and less.
 - 2. Transient voltage suppression devices.
 - 3. Disconnecting and overcurrent protective devices.
 - 4. Instrumentation.
 - 5. Accessory components and features.
 - 6. Identification.
 - 7. Mimic bus.
- B. Manufacturer shall provide Start-up Services for all Switchboards. Electrical Contractor shall schedule and complete the start-up services two (2) weeks prior to the switchboards being energized.

1.3 REFERENCES

- A. The switchboard(s) and overcurrent protection devices referenced herein are designed and manufactured according to the following appropriate specifications.
 - 1. ANSI/NFPA 70 - National Electrical Code (NEC).
 - 2. ANSI/IEEE C12.16 - Solid-State Electricity Metering.
 - 3. ANSI C57.13 - Instrument Transformers.
 - 4. NEMA AB 1 - Molded Case Circuit Breakers and Molded Case Switches.
 - 5. NEMA PB 2 - Deadfront Distribution Switchboards, File E8681
 - 6. NEMA PB 2.1 - Proper Handling, Installation, Operation and Maintenance of Deadfront Switchboards Rated 600 Volts or Less.
 - 7. NEMA PB 2.2 - Application Guide for Ground Fault Protective Devices for Equipment.
 - 8. UL 50 - Cabinets and Boxes.
 - 9. UL 98 - Enclosed and Dead Front Switches.
 - 10. UL 489 - Molded Case Circuit Breakers.
 - 11. UL 891 - Dead-Front Switchboards.
 - 12. UL 943 - Standard for Ground Fault Circuit Interrupters.
 - 13. Federal Specification W-C-375B/Gen - Circuit Breakers, Molded Case, Branch Circuit and Service.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of Switchboard, overcurrent protective device, transient voltage suppression device, ground-fault protector, accessory, and component indicated. Include dimensions and

manufacturers' technical data on features, performance, electrical characteristics, ratings, accessories, and finishes.

- B. Shop Drawings: For each Switchboard and related equipment.
 - 1. Include dimensioned plans, front and side elevations, sections, and details, including required clearances and service space around equipment. Show tabulations of installed devices, equipment features, and ratings.
 - 2. Conduit entrance locations and requirements; nameplate legends; one-line riser diagrams; equipment schedule; and switchboard instrument details.
 - 3. Detail enclosure types for types other than NEMA 250, Type 1.
 - 4. Detail bus configuration, current, and voltage ratings.
 - 5. Detail short-circuit current rating of Switchboards and overcurrent protective devices.
 - 6. Include descriptive documentation of optional barriers specified for electrical insulation and isolation.
 - 7. Detail utility company's metering provisions with indication of approval by utility company.
 - 8. Include evidence of NRTL listing for series rating of installed devices.
 - 9. Detail features, characteristics, ratings, and factory settings of individual overcurrent protective devices and auxiliary components.
 - 10. Include time-current coordination curves for each type and rating of overcurrent protective device included in Switchboards. Submit on translucent log-log graft paper; include selectable ranges for each type of overcurrent protective device.
 - 11. Include diagram and details of proposed mimic bus.
 - 12. Include schematic and wiring diagrams for power, signal, and control wiring.

1.5 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For qualified Installer.
- B. Field Quality-Control Reports:
 - 1. Test procedures used.
 - 2. Test results that comply with requirements.
 - 3. Results of failed tests and corrective action taken to achieve test results that comply with requirements.

1.6 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For Switchboards and components to include in emergency, operation, and maintenance manuals. Include the following:
 - 1. Routine maintenance requirements for Switchboards and all installed components.
 - 2. Manufacturer's written instructions for testing and adjusting overcurrent protective devices.
 - 3. Time-current coordination curves for each type and rating of overcurrent protective device included in Switchboards. Submit on translucent log-log graft paper; include selectable ranges for each type of overcurrent protective device.

1.7 MAINTENANCE MATERIAL SUBMITTALS

- A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
 - 1. Potential Transformer Fuses: Equal to 10 percent of quantity installed for each size and type, but no fewer than two of each size and type.
 - 2. Control-Power Fuses: Equal to 10 percent of quantity installed for each size and type, but no fewer than two of each size and type.
 - 3. Indicating Lights: Equal to 10 percent of quantity installed for each size and type, but no fewer than one of each size and type.

1.8 QUALITY ASSURANCE

- A. Installer Qualifications: An employer of workers qualified as defined in NEMA PB 2.1 and trained in electrical safety as required by NFPA 70E.
- B. Source Limitations: Obtain Switchboards, overcurrent protective devices, components, and accessories from single source from single manufacturer.
- C. Product Selection for Restricted Space: Drawings indicate space available for Switchboards including clearances between Switchboards and adjacent surfaces and other items. Equipment installed must meet all clearance, access and replacement working space requirements of the NEC and Owner.
- D. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- E. Comply with NEMA PB 2.
- F. Comply with NFPA 70.
- G. Comply with UL 891.

1.9 DELIVERY, STORAGE, AND HANDLING

- A. Deliver Switchboards in sections or lengths that can be moved past obstructions in delivery path.
- B. Handle and prepare Switchboards for installation according to NECA 400 and NEMA PB 2.1. Lift only by lifting means provided for this express purpose. Handle carefully to avoid damage to switchboard internal components, enclosure, and finish.
- C. Deliver, store, protect, and handle products in conformance with manufacturer's recommended practices as outlined in applicable Installation and Maintenance Manuals.
- D. Each switchboard section shall be delivered in individual shipping splits for ease of handling. They shall be individually wrapped for protection and mounted on shipping skids.
- E. Accept equipment on site and inspect and report concealed damage to carrier within their required time period.
- F. Store in a clean, dry space. Maintain factory protection and/or provide an additional heavy canvas or heavy plastic cover to protect structure from dirt, water, construction debris, and traffic. Where applicable, provide adequate heating within enclosures to prevent condensation.

1.10 PROJECT CONDITIONS

- A. Product Selection for Restricted Space: Drawings indicate space available for switchgear, including clearances between switchgear and adjacent surfaces and other items. Equipment installed must make all clearance, access and replacement working space requirements of the NEC and Owner.
- B. Installation Pathway: Remove and replace access fencing, doors, lift-out panels, and structures to provide pathway for moving Switchboards into place.
- C. Environmental Limitations:
 - 1. Do not deliver or install Switchboards until spaces are enclosed and weathertight, wet work in spaces is complete and dry, work above Switchboards is complete, and temporary HVAC system is operating and maintaining ambient temperature and humidity conditions at occupancy levels during the remainder of the construction period.
 - 2. Rate equipment for continuous operation under the following conditions unless otherwise indicated:
 - a. Ambient Temperature: Not exceeding 104 deg F (40 deg C).
 - b. Altitude: Not exceeding 6600 feet (2000 m).
- D. Interruption of Existing Electric Service: Do not interrupt electric service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary electric service according to requirements indicated:

1. Notify Construction Manager no fewer than 14 days in advance of proposed interruption of electric service.
2. Indicate method of providing temporary electric service.
3. Do not proceed with interruption of electric service without Construction Manager's written permission.
4. Comply with NFPA 70E.

1.11 COORDINATION

- A. Coordinate layout and installation of Switchboards and components with other construction that penetrates walls or is supported by them, including electrical and other types of equipment, raceways, piping, encumbrances to workspace clearance requirements, and adjacent surfaces. Maintain required workspace clearances and required clearances for equipment access doors and panels.
- B. Coordinate sizes and locations of concrete bases with actual equipment provided. Cast anchor-bolt inserts into bases. Concrete, reinforcement, and formwork requirements are specified with concrete.

1.12 WARRANTY

- A. The equipment items shall be supported by service organizations which are reasonably convenient (less than 100 miles from project site) to the equipment installation in order to render satisfactory service to the equipment on a regular and emergency basis during the warranty period of the contract.
- B. All low-voltage switchboards, finishes, and all of its component parts, and controls shall have an unconditional one (1) year warranty. Warranty shall include finishes and all components to be free from defects in materials and workmanship for a period of one (1) year from date of Owner's acceptance. Replacement of low-voltage switchboards, faulty materials and the cost of labor to make the replacement shall be the responsibility of the Contractor.
- C. The Warranty specified in this Article shall not deprive the Owner of other rights the Owner may have under provisions of the Contract Documents and shall be in addition to and run concurrently with other warranties made by the Contractor under requirements of the Contract Documents.

PART 2 - PRODUCTS

2.1 MANUFACTURED UNITS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 1. Square D; a brand of Schneider Electric.
- B. Switchboards shall be service entrance labeled and listed by UL.
- C. The manufacturer of the switchboard shall be the same as the manufacturer of the circuit breakers or the switches mounted in the switchboard.
- D. All new panelboards, distribution panelboards and switchboards on this project shall be by the same manufacture as the switchboard for the purposes of stocking common breaker types, series ratings, etc.
- E. Indoor Enclosure: Steel, NEMA 250, Type 1 - General Purpose.
 1. Sections shall be aligned front and rear.
 2. Removable steel base channels (1.5 inch floor sills) shall be bolted to the frame to rigidly support the entire shipping section for moving on rollers and floor mounting.
 3. The switchboard enclosure shall be painted on all surfaces. The paint finish shall be a medium gray, ANSI #49, applied by the electro-deposition process over an iron phosphate pre-treatment.
 4. All front covers shall be screw removable with a single tool and all doors shall be hinged with removable hinge pins.
 5. Top and bottom conduit areas shall be clearly indicated on shop drawings.

- F. Short Circuit Current Rating: Switchboards shall be rated with a minimum short circuit current rating of 100,000 AIC, unless otherwise indicated on Power Distribution Riser Diagram.
 - G. Nominal System Voltage: As indicated on Power Distribution Riser.
 - H. Main-Bus Continuous: As indicated on Power Distribution Riser.
 - I. Bus Composition: Shall be silver plated, hard-drawn copper of 98% conductivity. Plating shall be applied continuously to all bus work. The switchboard bussing shall be of sufficient cross-sectional area to meet UL Standard 891 temperature rise requirements. The phase and neutral through-bus shall have an ampacity as shown in the plans. For 4-wire systems, the neutral shall be of equivalent ampacity as the phase bus bar. Tapered bus is not acceptable. Full provisions for the addition of future sections shall be provided. Bussing shall include all necessary hardware to accommodate splicing for future additions.
 - J. Bus Connections: Shall be bolted with Grade 5 bolts and conical spring washers.
 - K. Ground Bus: Sized per NFPA70 and UL 891 Tables 25.1 and 25.2 and shall extend the entire length of the switchboard. Provisions for the addition of future sections shall be provided.
 - L. Future Provisions: All unused spaces provided, unless otherwise specified, shall be fully equipped for future devices, including all appropriate connectors and mounting hardware.
 - M. Barriers: Between adjacent switchboard sections.
 - N. Insulation and isolation for main and vertical buses of feeder sections. Fire pump breakers shall be isolated per NFPA and UL requirements.
 - O. Bus Transition and Incoming Pull Sections: Matched and aligned with basic switchgear.
 - P. Hinged Front Panels: Allow access to circuit breaker, metering, accessory, and blank compartments.
 - Q. Pull Box on Top of Switchboards:
 - 1. Adequate ventilation to maintain temperature in pull box within same limits as switchgear.
 - 2. Set back from front to clear circuit-breaker removal mechanism.
 - 3. Removable covers shall form top, front, and sides.
 - 4. Bottom shall be insulating, fire-resistive material with separate holes for cable drops into switchgear.
 - 5. Cable supports shall be arranged to facilitate cabling and adequate to support cables indicated, including those for future installation.
 - R. Phase-, Neutral- and Ground-Bus Material: Hard-drawn copper of 98 percent conductivity, silver-plated, with copper feeder circuit-breaker line connections.
 - S. All bus bars shall extend full length of equipment to permit future additions.
 - T. Neutral Buses: 100 percent of the ampacity of phase buses unless otherwise indicated, equipped with mechanical connectors for outgoing circuit neutral cables. Brace bus extensions for busway feeder neutral bus.
 - U. Isolation Barrier Access Provisions: Permit checking of bus-bolt tightness.
 - V. Provide equipment ground fault protection for all 3-phase, 120/208 volt for all overcurrent devices 1200 amps or greater.
 - W. Future Devices: Equip compartments with mounting brackets, supports, bus connections, and appurtenances at full rating of circuit-breaker compartment.
- 2.2 INCOMING MAIN AND TIE SECTION DEVICES
- A. Two-step stored energy electronic trip molded case circuit breaker(s)
 - 1. Circuit protective devices shall be two-step stored energy type circuit breaker(s).

2. Circuit breaker trip system shall be a microprocessor-based true rms sensing design with sensing accuracy through the thirteenth (13th) harmonic. Sensor ampere ratings shall be as indicated on the associated schedules and drawings.
3. The integral trip system shall be independent of any external power source and shall contain no less than industrial grade electronic components.
4. Circuit breakers shall be equipped with back-up thermal and magnetic trip system.
5. The ampere rating of the circuit breaker shall be determined by the combination of an interchangeable rating plug, the sensor size and the long-time pickup adjustment on the circuit breaker. The sensor size, rating plug and switch adjustments shall be clearly marked on the face of the circuit breaker. Circuit breakers shall be UL Listed to carry 100% of their ampere rating continuously when applied in QED switchboards.
6. The following time/current response adjustments shall be provided. Each adjustment shall have discrete settings and shall be independent from all other adjustments.
 - a. Long Time Pickup & Long Time Delay
 - b. Short Time Pickup & Short Time Delay (I^2t IN and I^2t OUT)
 - c. Instantaneous Pickup
 - d. Ground Fault Pickup & Ground Fault Delay (I^2t IN and I^2t OUT)
 - e. Ground Fault Alarm Only Pickup
7. A means to seal the rating plug and trip unit adjustments in accordance with NEC Section 240-6(b) shall be provided.
8. Local visual trip indication for overload, short circuit and ground fault trip occurrences shall be provided.
9. An ammeter to individually display all phase currents flowing through the circuit breaker shall be provided. Indication of inherent ground fault current flowing in the system shall be provided on circuit breakers with integral ground fault protection. All current values shall be displayed in True rms with 2% accuracy.
10. Long Time Pickup indication to signal when loading approaches or exceeds the adjusted ampere rating of the circuit breaker shall be provided.
11. The trip system shall include a Long Time memory circuit to protect against intermittent overcurrent conditions above the long time pickup point. Means shall be provided to reset Long Time memory circuit during primary injection testing.
12. Circuit breaker trip system shall be equipped with an externally accessible test port for use with a Universal Test Set. Provide one (1) Universal Equipment Test Set for this project job for final inspection. This test set shall be suitable for testing all electric circuit breakers specified for this project. No disassembly of the circuit breaker is required for testing.
13. Communications capabilities for remote monitoring of circuit breakers trip system, to include phase and ground fault currents, pre-trip alarm indication, switch settings and trip history information shall be provided.
14. Circuit breakers shall be provided with Zone Selective Interlocking (ZSI) communications capabilities on the short time and ground fault functions compatible with all other electronic trip circuit breakers and external ground fault sensing systems as noted on schedules and drawings.
15. True two-step stored energy mechanism with five (5) cycle closing time shall be provided. All circuit breakers shall have multiple CHARGE/CLOSE provisions allowing the following sequence:
CHARGE, CLOSE, RECHARGE, OPEN/CLOSE/OPEN
16. Local control pushbuttons to OPEN and CLOSE circuit breaker shall be provided. Color coded visual indication of contact position (OPEN or CLOSED) shall be provided on the face of the circuit breaker. Local manual charging following CLOSE operation shall be provided. Color coded visual indication of mechanism CHARGED and DISCHARGED position shall be provided on the face of the circuit breaker. Visual indicator shall indicate CHARGED only when closing springs are completely charged.

17. Each circuit breaker shall be electrically operated to permit remote CHARGE, CLOSE, and OPEN capabilities. Electrically operated circuit breaker shall be equipped with charge contact switch for remote indication of mechanism charge status.
 18. All circuit breakers shall be equipped with electrical accessories as noted on schedules and drawings.
 19. Provide the following interlocking capabilities:
 - a. cell door interlock
 - b. key interlock for main-tie-main
 - c. lock off
 20. Equipment Ground Fault Protection
 - a. Circuit breaker(s) shall be provided with integral equipment protection for grounded systems.
 - b. The ground fault system shall be of the residual type.
 - c. Circuit breaker(s) shall be provided with zone selective interlocking (ZSI) on the Ground Fault function in order to limit thermal stress caused by a fault, yet permit optimum coordination with all other electronic trip circuit breakers.
 21. Terminations
 - a. All lugs shall be UL Listed to accept solid and/or stranded copper conductors only.
 - b. All circuit breakers shall be UL Listed to accept field installable/removable lugs.
- B. Individually draw-out mounted through 5000 A
1. Main and Tie circuit breaker shall be individually draw-out mounted.
 2. Sturdy drawout rails shall be permanently attached to the sides of the breaker compartment and retract into the compartment when not in use.
 3. When fully withdrawn, the circuit breaker shall permit access for inspection and testing. Circuit breaker(s) shall also be removable from the rails completely.
 4. When the circuit breaker is in the Connected, Test, or Disconnected positions, or when the circuit breaker is removed from the compartment, the compartment door shall be able to be fully closed and secured.
 5. A removable crank shall be supplied with each Draw-out Switchboard for racking the circuit breaker between the Connected, Test, or Disconnected positions.
 6. Main breakers to have ZSI, Zone Selective Interlocking.
 7. Overhead Circuit Breaker Lifting Device shall be at all draw-out circuit breakers: Mounted at top front of switchboard, with hoist and lifting yokes matching each draw-out circuit breaker.
- 2.3 CONTROL POWER
- A. Control Circuits: 120-V ac, supplied through secondary disconnecting devices from control-power transformer, if required.
 - B. Control-Power Fuses: Primary and secondary fuses for current-limiting and overload protection of transformer and fuses for protection of control circuits.
 - C. Control Wiring: Factory installed, with bundling, lacing, and protection included. Provide flexible conductors for #8 AWG and smaller, for conductors across hinges, and for conductors for interconnections between shipping units.
- 2.4 ACCESSORY COMPONENTS AND FEATURES
- A. Accessory Set: Include tools and miscellaneous items required for overcurrent protective device test, inspection, maintenance, and operation.
 - B. Portable Test Set: For testing functions of solid-state trip devices without removing from switchgear. Include relay and meter test plugs suitable for testing switchgear meters and switchgear class relays.
 - C. Overhead Circuit Breaker Lifting Device: Mounted at top front of switchboard, with hoist and lifting yokes matching each draw-out circuit breaker.
 - D. Lock-out, Tag-out: All circuit breakers in the Switchboard to include fixed padlock attachments.

2.5 METERING

- A. Square D Model PM5563. Install in face of switchboard.

2.6 IDENTIFICATION

- A. Service Equipment Label: NRTL labeled for use as service equipment for Switchboards with one or more service disconnecting and overcurrent protective devices.

PART 3 - EXECUTION

3.1 INSPECTION

- A. Examine area to receive switchboard to provide adequate clearance for switchboard installation.
- B. Check that concrete pads are level and free of irregularities.
- C. Start work only after unsatisfactory conditions are corrected.

3.2 EXAMINATION

- A. Receive, inspect, handle, and store switchgears according to NECA 400 and NEMA PB 2.1.
- B. Examine Switchboards before installation. Reject Switchboards that are moisture damaged or physically damaged.
- C. Examine elements and surfaces to receive Switchboards for compliance with installation tolerances and other conditions affecting performance of the Work.
- D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.3 INSTALLATION

- A. Install Switchboards and accessories according to manufacturer's written guidelines, NECA 400 and NEMA PB 2.1.
- B. Equipment Mounting: Install Switchboards on concrete base, 4-inch nominal thickness. Comply with requirements for concrete base specified in Section 033000 "Cast-in-Place Concrete."
 - 1. Install dowel rods to connect concrete base to concrete floor. Unless otherwise indicated, install dowel rods on 18-inch centers around the full perimeter of concrete base.
 - 2. For supported equipment, install epoxy-coated anchor bolts that extend through concrete base and anchor into structural concrete floor.
 - 3. Place and secure anchorage devices. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
 - 4. Install anchor bolts to elevations required for proper attachment to Switchboards.
- C. Temporary Lifting Provisions: Remove temporary lifting eyes, channels, and brackets and temporary blocking of moving parts from Switchboard units and components.
- D. Operating Instructions: Frame and mount the printed basic operating instructions for Switchboards, including control and key interlocking sequences and emergency procedures. Fabricate frame of finished wood or metal and cover instructions with clear acrylic plastic. Mount on front of Switchboards.
- E. Install filler plates in unused spaces of panel-mounted sections.
- F. Install overcurrent protective devices, transient voltage suppression devices, and instrumentation.
 - 1. Set field-adjustable switches and circuit-breaker trip ranges.
- G. Comply with NECA 1.

3.4 IDENTIFICATION

- A. Identify field-installed conductors, interconnecting wiring, and components; provide warning signs complying with requirements for identification specified in Section 260553, "Identification for Electrical Systems".
- B. Switchboard Nameplates: Label each Switchboard compartment with a nameplate complying with requirements for identification specified in Section 260553, "Identification for Electrical Systems".
- C. Device Nameplates: Label each disconnecting and overcurrent protective device and each meter and control device mounted in compartment doors with a nameplate complying with requirements for identification specified in Section 260553, "Identification for Electrical Systems".

3.5 FIELD QUALITY CONTROL

- A. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust components, assemblies, and equipment installations, including connections.
- B. Perform tests and inspections.
 - 1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.
- C. Acceptance Testing Preparation:
 - 1. Test insulation resistance for each Switchboard bus, component, connecting supply, feeder, and control circuit.
 - 2. Test continuity of each circuit.
- D. Tests and Inspections:
 - 1. For all breakers with 250A frame and larger perform each visual and mechanical inspection and electrical test stated in NETA Acceptance Testing Specification. Certify compliance with test parameters.
 - 2. Correct malfunctioning units on-site, where possible, and retest to demonstrate compliance; otherwise, replace with new units and retest.
 - 3. Perform the following infrared scan tests and inspections and prepare reports:
 - a. Initial Infrared Scanning: After Substantial Completion, but not more than 60 days after Final Acceptance, perform an infrared scan of each Switchboard.
 - b. Follow-up Infrared Scanning: Perform an additional follow-up infrared scan of each Switchboard 11 months after date of Substantial Completion.
 - c. Instruments and Equipment:
 - 1) Use an infrared scanning device designed to measure temperature or to detect significant deviations from normal values. Provide calibration record for device.
 - d. Test and adjust controls, remote monitoring, and safeties. Replace damaged and malfunctioning controls and equipment.
 - 4. Inspect completed installation for physical damage, proper alignment, anchorage, and grounding.
 - 5. Measure, using a Megger, the insulation resistance of each bus section phase-to-phase and phase-to-ground for one minute each, at minimum test voltage of 1000 VDC; minimum acceptable value for insulation resistance is 1 megohms. NOTE: Refer to manufacturer's literature for specific testing procedures.
 - 6. Check tightness of accessible bolted bus joints using calibrated torque wrench per manufacturer's recommended torque values.
 - 7. Physically test key interlock systems to check for proper functionality.
 - 8. Test ground fault systems by operating push-to-test button.
- E. Switchboard will be considered defective if it does not pass tests and inspections.

3.6 QUALITY CONTROL/STARTUP

- A. Prepare test and inspection reports, including a certified report that identifies Switchboards included and that describes scanning results. Include notation of deficiencies detected, remedial action taken, and observations after remedial action.

3.7 ADJUSTING

- A. Tighten bolted bus connections in accordance with manufacturer's instructions.
- B. Adjust moving parts and operable components to function smoothly, and lubricate as recommended by manufacturer.
- C. Set field-adjustable circuit-breaker trip ranges and time delay settings to recommended values in the Overcurrent Protective Device Coordination Study. Refer to 260573, "Electrical Studies".

3.8 CLEANING

- A. On completion of installation, inspect interior and exterior of switchboards. Vacuum dirt and debris; do not use compressed air to assist in cleaning. Repair damaged finishes.
- B. Touch-up scratched or marred surfaces to match original finish.

3.9 DEMONSTRATION

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain Switchboards, overcurrent protective devices, instrumentation, and accessories, and to use and reprogram microprocessor-based trip, monitoring, and communication units.
- B. Training of the owner's operation and maintenance personnel is required in cooperation with the Commissioning Authority. The instruction shall be scheduled in coordination with the Commissioning Authority after submission and approval of formal training plans. Refer to Section 019113 and the Commissioning Plan for further contractor training requirements.

END OF SECTION

DIVISION 26 – ELECTRICAL

SECTION 262726 - WIRING DEVICES AND PLATES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General, Special and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.
- B. The Contractor is directed to examine each and every section of these specifications, all drawings relating to the Contract Documents, any and all Addenda, etc., for work described elsewhere that may relate to the provision of the work described herein. Materials and performance requirements are specified elsewhere herein that relate to these systems.
- C. Each Electrical Contractor's attention is directed to Section 260501 - General Provisions, Electrical, and all other Contract Documents as they apply to his work.

1.2 SUMMARY

- A. This section of the specifications covers all wiring devices and cover plates, standard, weatherproof and dust-tight.
- B. Wiring devices, listed by manufacturer and catalogue numbers are to establish the quality and type required. Equivalent devices of other manufacturers will be acceptable with prior approval of the Engineer. Submit cutsheets and/or samples of each type ten days prior to bid date for review and written approval to bid. Insofar as possible, standard application or special application devices shall be by one manufacturer.
- C. Section Includes:
 - 1. Receptacles, receptacles with integral GFCI, and associated device plates.

1.3 DEFINITIONS

- A. EMI: Electromagnetic interference.
- B. GFCI: Ground-fault circuit interrupter.
- C. Pigtail: Short lead used to connect a device to a branch-circuit conductor.
- D. RFI: Radio-frequency interference.
- E. TVSS: Transient voltage surge suppressor.
- F. UTP: Unshielded twisted pair.

1.4 ADMINISTRATIVE REQUIREMENT

- A. Coordination:
 - 1. Receptacles for Owner-Furnished Equipment: Match plug configurations.
 - 2. Cord and Plug Sets: Match equipment requirements.

1.5 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Shop Drawings: List of legends and description of materials and process used for pre-marking wall plates.
- C. Samples: One for each type of device and wall plate specified, in each color specified.

1.6 INFORMATIONAL SUBMITTALS

- A. Field quality-control reports.
- 1.7 CLOSEOUT SUBMITTALS
 - A. Operation and Maintenance Data: For wiring devices to include in all manufacturers' packing-label warnings and instruction manuals that include labeling conditions.
- 1.8 SYSTEM COMMISSIONING
 - A. Section 019113 requires the engagement of a Commissioning Authority to document the completion of the Mechanical, Fire Protection, Plumbing, Electrical, Electronic Safety and Security, and associated Control Systems for the project. Section 019113 defines the roles and responsibilities of each member of the commissioning team.
 - B. Comply with the requirements of Section 019113 for the commissioning of the various building systems.

PART 2 - PRODUCTS

- 2.1 MANUFACTURERS
 - A. Manufacturers' Names: Shortened versions (shown in parentheses) of the following manufacturers' names are used in other Part 2 articles:
 1. Hubbell Incorporated; Wiring Device-Kellems (Hubbell).
 2. Leviton Mfg. Company Inc. (Leviton).
 3. Pass & Seymour/Legrand (P&S).
 4. Cooper Wiring Devices; Division of Cooper Industries, Inc. (Cooper).
 - B. Source Limitations: Obtain each type of wiring device and associated wall plate from single source from single manufacturer.
- 2.2 GENERAL WIRING-DEVICE REQUIREMENTS
 - A. Wiring Devices, Components, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
 - B. Comply with NFPA 70.
 - C. Straight-Blade Receptacles
 1. Convenience Receptacles, 125 V, 20 A: Comply with NEMA WD 1, NEMA WD 6 Configuration 5-20R, UL 498, and FS W-C-596.
 2. Tamper-Resistant, Shutter-Type Convenience Receptacles, 125 V, 20 A: Comply with NEMA WD 1, NEMA WD 6 Configuration 5-20R, UL 498 Supplement sd, and FS W-C-596.
- 2.3 DEVICES

TYPE	RATING	CONFIGURATION	COLOR	VENDOR - CAT. #
RECEPTACLE, DUPLEX PREMIUM GRADE	125V, 20A	NEMA 5-20R	!	HUBBELL 5352 LEVITON or P & S Equal
* USE WHERE ON DEDICATED 20A CKT., OR CALLED OUT ** USE WHERE ON DEDICATED 15A CKT., OR WHERE MORE THAN ONE RECEPTACLE ON A CIRCUIT				
RECEPTACLE, SAFETY SHUTTER TYPE DUPLEX	125V, 20A	NEMA 5-20R	!	HUBBELL, LEVITON, or P & S equal

RECEPTACLE, DUPLEX GFI WITH AUDIBLE ALARM	125V, 20A	NEMA 5-20R	!	P & S 2095 TRAN LEVITON or HUBBELL equal
RECEPTACLE, DUPLEX, WEATHER RESISTANT, GFI	125V, 20A	NEMA 5-20R	!	HUBBELL # GFTR20 LEVITON #W7599TRE OR P & S Equal
RECEPTACLE, SIMPLEX	125V, 20A	NEMA 5-20R	!	HUBBELL 5361
RECEPTACLE, SINGLE	250V, 20A	NEMA 10-20R	BLACK	HUBBELL 6810 LEVITON or P & S Equal
RECEPTACLE, SINGLE	250V, 30A	NEMA 6-30R	BLACK	HUBBELL 9330 LEVITON or P & S Equal
RECEPTACLE, SINGLE	250V, 50A	NEMA 6-50R	BLACK	HUBBELL 9367 LEVITON or P & S Equal
SWITCH, SINGLE POLE	120/277V, 20A	SPST	!	HUBBELL HBL-1221 LEVITON or P & S Equal
SWITCH, THREE-WAY	120/277V, 20A	3-WAY	!	HUBBELL HBL-1223 LEVITON or P & S Equal
<p>NOTES:</p> <ol style="list-style-type: none"> 1. PROVIDE MATCHING CAP (PLUG) FOR ALL RECEPTACLES 30 AMP RATED AND ABOVE AS REQUIRED FOR EQUIPMENT. 2. ALL RECEPTACLES SHALL BE BACK OR SIDE-WIRED, CLAMPING TYPE 3. RECEPTACLES SHALL BE TAMPER RESISTANT AND WEATHER RESISTANT AND MARKED ACCORDINGLY AS REQUIRED BY NEC <p>! SEE PART 2.5, COLOR.</p>				

2.4 COLOR

- A. Color of devices shall be as selected by the architect. Outlets shown as "SP" or "SS" shall be blue. Samples (devices, plates or both) may be required to be submitted with other architectural color items by the Contractor. The Contractor shall coordinate any such submission required with other trades, the Prime Contractor or as needed.
- B. Where devices are controlling or supplying emergency power from a standby source, the device color shall be red, as with switch toggles or receptacle fronts. Plate color shall match others on normal power in the building unless otherwise noted.
- C. Where surface finishes next to the devices vary in color or shade throughout the project, the Contractor may be required to provide lighter or darker plates and devices to more closely match wall finishes. These variations are considered to be included in the original contract for construction.

2.5 PLATES AND COVERS

- A. Unless otherwise specified or noted, all wiring device plates and covers shall be 304 stainless steel. Plates shall have circuit and panel labeled per 260553, machine printed 1/4" black lettering on clear tape.
- B. Cover plates shall be of one manufacturer insofar as possible.
- C. Weatherproof, while in-use, plates for GFCI receptacles shall be cast aluminum, self-closing, gasketed, suitable for standard box mounting, UL listed for wet location use, cover closed. Vertical mounting - Hubbell WP26M, horizontal mounting - Hubbell WP26MH (die-cast zinc) or equivalent Leviton or P & S.
- D. Weatherproof switch plates for toggle-handle switches shall be clear silicone rubber, for standard outlet boxes. Hubbell 1795 or equivalent P & S or Leviton.
- E. Cover plates for computer, telephone or other system outlets shall be as color and finish to match receptacle plates in each space specified in other sections.
- F. All kitchen and food service area plates shall be smooth 304 stainless steel with foam gasket behind to help prevent water infiltration.

2.6 POKE-THROUGH ASSEMBLIES

- A. Manufacturers: Model numbers indicated on floor plans is basis-of-design. Subject to compliance with requirements, provide products by one of the following approved manufacturers:
 - 1. Hubbell Incorporated; Wiring Device-Kellems.
 - 2. Pass & Seymour/Legrand.
 - 3. Square D/Schneider Electric.
 - 4. Thomas & Betts Corporation.
 - 5. Wiremold/Legrand.
- B. Description:
 - 1. Factory-fabricated and -wired assembly of below-floor junction box with multi-channeled, through-floor raceway/firestop unit and detachable matching floor service-outlet assembly.
 - 2. Comply with UL 514 scrub water exclusion requirements.
 - 3. Size: Selected to fit nominal 8-inch cored holes in floor and matched to floor thickness.
 - 4. Fire Rating: Unit is listed and labeled for 2-hour fire rating of floor-ceiling assembly.
 - 5. Closure Plug: Arranged to close unused cored openings and reestablish fire rating of floor.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Comply with NECA 1, including mounting heights listed in that standard, unless otherwise indicated.
- B. All wiring devices in dusty areas, exposed to weather and moisture shall be installed in Type "FS" conduit fittings having mounting hubs, with appropriate cover plates.
- C. Devices that have been installed before painting shall be masked. No plates or covers shall be installed until all finishing and cleaning has been completed.
- D. Provide GFCI duplex feed-thru style receptacles where indicated or required by the National Electrical Code, whether specifically called out or not. When a GFCI receptacle is on a circuit with other non-GFCI receptacles, it shall always be placed at the homerun point of the circuit and shall be wired to ground-fault interrupt protect the downstream outlets on that circuit unless specifically indicated to the contrary. Provide a "GFCI protected" label on each downstream outlet. GFCI receptacles shall audibly alarm when tripped.
- E. All receptacles shall be installed with ground prong at bottom position.

- F. All device face plates shall be labeled with panel and circuit designation by means of machine printed clear, adhesive tape with 1/4" black lettering.
 - G. All device boxes shall have circuit number identified within the box.
 - H. Coordination for all receptacles except NEMA 5 Configuration: Contractor shall confirm receptacle configuration of all special purpose receptacles prior to installation and provide devices to match equipment. Contractor shall replace any incompatible receptacle discovered during owner move-in.
 - I. Coordination with Other Trades:
 - 1. Protect installed devices and their boxes. Do not place wall finish materials over device boxes and do not cut holes for boxes with routers that are guided by riding against outside of boxes.
 - 2. Keep outlet boxes free of plaster, drywall joint compound, mortar, cement, concrete, dust, paint, and other material that may contaminate the raceway system, conductors, and cables.
 - 3. Install device boxes in brick or block walls so that the cover plate does not cross a joint unless the joint is troweled flush with the face of the wall.
 - 4. Install wiring devices after all wall preparation, including painting, is complete.
 - J. Conductors:
 - 1. Do not strip insulation from conductors until right before they are spliced or terminated on devices.
 - 2. Strip insulation evenly around the conductor using tools designed for the purpose. Avoid scoring or nicking of solid wire or cutting strands from stranded wire.
 - 3. The length of free conductors at outlets for devices shall meet provisions of NFPA 70, Article 300, without pigtails.
 - K. Device Installation:
 - 1. Replace devices that have been in temporary use during construction and that were installed before building finishing operations were complete.
 - 2. Keep each wiring device in its package or otherwise protected until it is time to connect conductors.
 - 3. Do not remove surface protection, such as plastic film and smudge covers, until the last possible moment.
 - 4. Connect devices to branch circuits using pigtails that are not less than 6 inches (152 mm) in length.
 - 5. Use a torque screwdriver when a torque is recommended or required by manufacturer.
 - 6. When conductors larger than #12 AWG are installed on 15- or 20-A circuits, splice #12 AWG pigtails for device connections.
 - 7. Tighten unused terminal screws on the device.
 - 8. When mounting into metal boxes, remove the fiber or plastic washers used to hold device-mounting screws in yokes, allowing metal-to-metal contact.
 - 9. Install switches with "OFF" position down.
 - L. Device Plates: Do not use oversized or extra-deep plates. Repair wall finishes and remount outlet boxes when standard device plates do not fit flush or do not cover rough wall opening.
 - M. Adjust locations of floor service outlets and service poles to suit arrangement of partitions and furnishings.
- 3.2 IDENTIFICATION: Comply with Division 26 Section "Identification for Electrical Systems.
- 3.3 FIELD QUALITY CONTROL
- A. Perform the following tests and inspections:
 - 1. Test Instruments: Use instruments that comply with UL 1436.
 - 2. Test Instrument for Convenience Receptacles: Digital wiring analyzer with digital readout or illuminated digital-display indicators of measurement.

- B. Wiring device will be considered defective if it does not pass tests and inspections.
- C. Tests for Convenience Receptacles:
 - 1. Line-Voltage: Acceptable range is 105 to 132 V.
 - 2. Percent Voltage Drop under 15-A Load: A value of 6 percent or higher is unacceptable.
 - 3. Ground Impedance: Values of up to 2 ohms are acceptable.
 - 4. GFCI Trip: Test for tripping values specified in UL 1436 and UL 943.
 - 5. Using the test plug, verify that the device and its outlet box are securely mounted.
 - 6. Tests shall be diagnostic, indicating damaged conductors, high resistance at the circuit breaker, poor connections, inadequate fault current path, defective devices, or similar problems. Correct circuit conditions, remove malfunctioning units and replace with new ones, and retest as specified above.
- D. Wiring device will be considered defective if it does not pass tests and inspections.
- E. Prepare test and inspection reports.

END OF SECTION

DIVISION 26 – ELECTRICAL

SECTION 262816 – ENCLOSED SWITCHES AND CIRCUIT BREAKERS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General, Special and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.
- B. The Contractor is directed to examine each and every section of these specifications, all drawings relating to the Contract Documents, any and all Addenda, etc., for work described elsewhere that may relate to the provision of the work described herein. Materials and performance requirements are specified elsewhere herein that relate to these systems.
- C. Each Electrical Contractor's attention is directed to Section 260501 - General Provisions, Electrical, and all other Contract Documents as they apply to his work.

1.2 SUMMARY

- A. Section includes:
 - 1. Non-Fusible Switches
 - 2. Individually Mounted Circuit Breakers
 - 3. Enclosures.

1.3 DEFINITIONS

- A. GFCI: Ground-fault circuit interrupter
- B. HD: Heavy Duty

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of enclosed switch, circuit breaker, accessory, and component indicated. Include dimensioned elevations, sections, weights, and manufacturers' technical data on features, performance, electrical characteristics, ratings, and finishes.
 - 1. Enclosure types and details for types other than NEMA 250, Type 1.
 - 2. Current and voltage ratings.
 - 3. Short-circuit current ratings (interrupting and withstand, as appropriate).
 - 4. Detail features, characteristics, ratings, and factory settings of individual overcurrent protective devices, accessories, and auxiliary components.
- B. Shop Drawings: For each type of enclosed switch, circuit breaker, accessory, and component indicated.
 - 1. Include dimensioned plans, elevations, sections, and details. Show tabulations of installed devices, equipment features, and ratings.
 - 2. Detail enclosure types and details for types other than NEMA 250, Type 1.
 - 3. Detail bus configuration, current, and voltage ratings.
 - 4. Short-circuit current rating of overcurrent protective devices.
 - 5. Include evidence of NRTL listing for series rating of installed devices.
 - 6. Detail features, characteristics, ratings, and factory settings of individual overcurrent protective devices and auxiliary components.
 - 7. Include wiring diagrams for power, signal, and control wiring.

1.5 CLOSEOUT SUBMITTALS

- A. Manufacturer's written instructions for testing and adjusting overcurrent protective devices.

- B. Time-current curves, including selectable ranges for each type of overcurrent protective device that allows adjustments.

1.6 QUALITY ASSURANCE

- A. Source Limitations: Obtain enclosed switches, circuit breakers, accessory, and component indicated from single source from single manufacturer.
- B. Product Selection for Restricted Space: Drawings indicate space available for enclosed switches including clearances between enclosed switches and adjacent surfaces and other items. Furnish and install equipment to comply with NEC clearances.
- C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

1.7 WARRANTY

- A. The equipment items shall be supported by service organizations which are reasonably convenient (less than 100 miles from project site) to the equipment installation in order to render satisfactory service to the equipment on a regular and emergency basis during the warranty period of the contract.
- B. All enclosed switches and circuit breakers, finishes, and all of its component parts, and controls shall have an unconditional one (1) year warranty. Warranty shall include finishes and all components to be free from defects in materials and workmanship for a period of one (1) year from date of Owner's acceptance. Replacement of enclosed switches and circuit breakers, faulty materials and the cost of labor to make the replacement shall be the responsibility of the Contractor.
- C. The Warranty specified in this Article shall not deprive the Owner of other rights the Owner may have under provisions of the Contract Documents and shall be in addition to, and run concurrently with other warranties made by the Contractor under requirements of the Contract Documents.
- D. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace surge suppression devices that fail in materials or workmanship within specified warranty period.
 - 1. Warranty Period: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Square D; a brand of Schneider Electric.

2.2 INDIVIDUALLY MOUNTED MOLDED-CASE CIRCUIT BREAKERS

- A. General Requirements: Comply with UL 489, NEMA AB 1, and NEMA AB 3, with interrupting capacity to comply with available fault currents.
- B. Thermal-Magnetic Circuit Breakers: Inverse time-current element for low-level overloads and instantaneous magnetic trip element for short circuits. Adjustable magnetic trip setting for circuit-breaker frame sizes 250 A and larger.
- C. Electronic Trip Circuit Breakers: Field-replaceable rating plug, rms sensing, with the following field-adjustable settings:
 - 1. Instantaneous trip.
- D. Current-Limiting Circuit Breakers: Frame sizes 400 A and smaller, and let-through ratings less than NEMA FU 1, RK-5.
- E. Ground-Fault, Circuit-Interrupter (GFCI) Circuit Breakers: Single- and two-pole configurations with Class A ground-fault protection (6-mA trip).

F. Features and Accessories:

1. Standard frame sizes, trip ratings, and number of poles.
2. Lugs: Mechanical type, suitable for number, size, trip ratings, and conductor material.
3. Ground-Fault Protection: Comply with UL 1053; integrally mounted, self-powered type with mechanical ground-fault indicator; relay with adjustable pickup and time-delay settings, push-to-test feature, internal memory, and shunt trip unit; and three-phase, zero-sequence current transformer/sensor.

2.3 ENCLOSURES

- A. Enclosed Switches and Circuit Breakers: NEMA AB 1, NEMA KS 1, NEMA 250, and UL 50, to comply with environmental conditions at installed location.
1. Indoor, Dry and Clean Locations: NEMA 250, Type 1.
 2. Outdoor Locations: NEMA 250, Type 3R.
 3. Kitchen and Wash-Down Areas: NEMA 250, Type 4X, stainless steel.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine elements and surfaces to receive enclosed switches and circuit breakers for compliance with installation tolerances and other conditions affecting performance of the Work.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Install individual wall-mounted switches and circuit breakers with tops at uniform height unless otherwise indicated.
- B. Securely fasten each switch, circuit breaker and combination starter to the supporting structure or wall, utilizing a minimum of four (4) 1/4 inch bolts. Do not mount in an inaccessible location or where the passageway to the switch may become obstructed.
- C. Install fuses in fusible devices.
- D. Comply with NECA 1.

3.3 IDENTIFICATION

- A. Comply with requirements in Division 26 Section "Identification for Electrical Systems."
1. Identify field-installed conductors, interconnecting wiring, and components; provide warning signs.
 2. Label each enclosure with engraved metal or laminated-plastic nameplate.

3.4 ADJUSTING

- A. Adjust moving parts and operable components to function smoothly, and lubricate as recommended by manufacturer.
- B. Set field-adjustable circuit-breaker trip ranges as specified in Division 26 Section "Electrical Studies".

END OF SECTION

DIVISION 26 – ELECTRICAL

SECTION 265000 - LIGHTING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General, Special and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.
- B. The Contractor is directed to examine each and every section of these specifications, all drawings relating to the Contract Documents, any and all Addenda, etc., for work described elsewhere that may relate to the provision of the work described herein. Materials and performance requirements are specified elsewhere herein that relate to these systems.
- C. Each Electrical Contractor's attention is directed to Section 260501 - General Provisions, Electrical, and all other Contract Documents as they apply to his work.

1.2 SUMMARY

- A. Section Includes Interior and Exterior Luminaires, Supports and Accessories

1.3 DESCRIPTION OF WORK

- A. This work consists of providing all labor, materials, accessories, mounting hardware and equipment necessary for an operationally and aesthetically complete installation of all luminaires, including power wiring, control wiring and accessories, in accordance with the contract documents.
- B. Contractor shall coordinate with Vendors and other trades, in advance of installation work, to define all infrastructure and installation requirements. Contractor shall coordinate all infrastructure requirements with all approved lighting equipment prior to infrastructure installation. This includes, but not limited to, appropriately sized, positioned, and located junction boxes, structural supports, feeds, power conduits and control conduits, and remote code-compliant power-supply enclosures.
- C. Contractor shall provide all luminaires, as herein specified, complete with lamps, drivers, power supplies, ballasts and accessories for safe and effective operation. All fixtures shall be installed and left in an operable condition with no broken, damaged or soiled parts.
- D. Contractor shall coordinate all infrastructure requirements with all approved lighting equipment prior to infrastructure installation, including, but not limited to appropriately sized, positioned and located junction boxes, structural supports, feeds, power and control conduits, and remote code-compliant power-supply enclosures.
- E. All luminaires, items, equipment and parts furnished and specified herein shall bear the "UL Approved" label (or other NRTL label) to indicate compliance with UL requirements. All luminaires shall be manufactured in strict accordance with the appropriate and current requirements of the National Electrical Code as verified by Underwriters Laboratories, Inc. (UL), or tested to UL standards by other nationally recognized testing laboratory (NRTL) as acceptable to Building Officials and Code Administrators International (BOCAI); the International Conference of Building Officials (ICBO); or other relevant code authority recognized by the local jurisdiction within which the project is being constructed. Such a listing shall be provided for each luminaire type, and the appropriate label or labels shall be affixed to each luminaire in a location as required by code or law. All luminaires shall be UL/NRTL listed and labeled for installation in fireproof or non-fireproof construction, dry, damp, or wet locations, as required.
- F. All available finishes and colors, for each luminaire, shall be submitted to the Architect for selection during shop drawing review. Premium finishes, where indicated, shall be provided at no additional cost premium.
- G. Specifications and drawings are intended to convey all salient features, functions and characteristics of the luminaires only, and do not undertake to illustrate or set forth every item or detail necessary for the work. Minor details, not usually indicated on the drawings nor specified, but that are necessary for proper

execution and completion of the luminaries, shall be included, the same as if they were herein specified or indicated on the drawings.

- H. The Owner, Architect and Engineer shall not be held responsible for the omission or absence of any detail, construction feature, etc. which may be required in the production of the light fixtures. The responsibility of accurately fabricating the light fixtures to the fulfillment of the specification rests with the Contractor.
 - I. Refer to architectural details as applicable for recessed soffit fixtures or wherever fixture installations depend upon work of other trades. Coordinate all installations with other trades. Verify dimensions of spaces for fixtures, and if necessary, adjust lengths to assure proper fit and illumination of diffuser and/or area below.
 - J. In accordance with the above and the criteria established herein, the Contractor is responsible for assuring the final design, fabrication and installation which fulfills the requirements of the Contract Documents.
- 1.4 CODES: Materials and installations shall be in accordance with the latest revision of the National Electrical Code and any applicable Federal, State and local codes and regulations.
- 1.5 REFERENCE STANDARDS: The publications listed below (including amendments, addenda, revisions, supplements, and errata) form a part of this specification to the extent referenced. The publications may be referred to in the text by the basic designation only.
- A. American National Standards Institute (ANSI)
 - B. American Society for Testing and Materials (ASTM)
 - C. Certified Ballast Manufacturers Association (CBM): Requirements for Ballast Certification.
 - D. Federal Communications Commission (FCC)
 - E. Entertainment Services and Technology Association: ESTA E1.3 - Entertainment Technology - Lighting Control System - 0 to 10V Analog Control Protocol
 - F. International Electrotechnical Commission (IEC)
 - G. Illuminating Engineering Society of North America (IESNA)
 - H. Institute of Electrical and Electronic Engineers (IEEE): C62.41-91 - Recommended Practice on Surge Voltage in Low Voltage AC Power Circuits
 - I. National Fire Protection Association (NFPA):
 - 1. NFPA 70 - National Electrical Code (NEC), National Fire Protection Association
 - 2. NFPA 101 - Life Safety Code, National Fire Protection Association
 - J. National Electrical Manufacturer's Association (NEMA)
 - K. OSHA 29CFR1910.7 – Luminaires shall be listed by National Recognized Testing Laboratory Approved by United States Department of Labor.
 - L. Underwriters Laboratories, Inc. (UL)
- 1.6 ACRONYMS AND DEFINITIONS
- A. Light Fixture (Luminaire): Complete lighting unit consisting of a lamp(s) and driver(s)/ballast(s) (when applicable) together with the parts designed to distribute the light, to position and protect the lamp(s), and to connect the lamps to the power supply.
 - B. Unless otherwise specified or indicated, electrical and electronics terms used in these specifications, and on the drawings, shall be as defined in IEEE 100.
- 1.7 EQUAL MANUFACTURERS
- A. Manufacturers listed as "Equal" to the Basis of Design on the light fixture schedule shall submit product cutsheets to the Engineer ten (10) days prior to bid for final written approval. This written approval will

only be issued in addendum form. "Equal" fixtures shall be of equal or better quality and performance to the fixture(s) listed with manufacturer's model numbers. Burden of proof shall be on the Contractor, Vendor and manufacturer.

- B. Upon request by Engineer, the Contractor shall submit manufacturer's computerized horizontal illumination levels using AGI32 software in footcandles at workplane (30" above finished floor), taken every 3 feet in every interior room and area. Include average maintained footcandle levels and maximum and minimum ratio.
- C. Upon request by Engineer, the Contractor shall submit manufacturer's computerized horizontal illumination levels using AGI32 software in footcandles, taken every ten (10) feet at grade for the entire exterior site. Include average maintained footcandle levels and maximum and minimum ratio.

1.8 SUBMITTALS

- A. Submittal data shall be in accordance with Division 01 SUBMITTAL Specification Section, IECC and as specified herein.
- B. Light fixture factory shop drawings and cuts, showing fixture dimensions, photometric data and installation data shall be submitted to the Engineer for review 15 days after project award date.
- C. Product Data: For each type and model of lighting fixture, arranged in order of fixture designation. Include data on features, accessories, finishes, and the following:
 - 1. Physical description of lighting fixture including dimensions.
 - 2. Emergency lighting units including battery and charger.
 - 3. All available finishes and colors for each luminaire type shall be submitted to the Architect for selection during review.
 - 4. Life, output (lumens, CCT, and CRI), and energy-efficiency data for light fixtures.
 - 5. Dimensions, effective projected area (EPA), accessories, installation details and construction details.
 - 6. Poles: Include dimensions, wind load determined in accordance with AASHTO, pole deflection, pole class, and other applicable information.
 - 7. Distribution data according to IESNA classification type as defined in IESNA HB-10.
 - 8. Amount of shielding on luminaires.
 - 9. Control type: 0-10V, DMX, bi-level, etc.
 - 10. Warranty.
- D. Shop Drawings: Including plans, elevations, sections, details, and attachment to other work.
 - 1. Include detailed equipment assemblies and indicate electrical ratings, dimensions, emergency section, control type, wiring, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
 - 2. Anchor-bolt templates keyed to specific poles and certified by manufacturer.
- E. Pole and Support Component Certification Certificates: Signed by manufacturers of poles, certifying that products are designed for indicated load requirements in AASHTO LTS and that load imposed by luminaire and attachments has been included in design. The certification shall be based on design calculations by a professional engineer.

1.9 QUALITY ASSURANCE

- A. In each of the publications referred to herein, consider the advisory provisions to be mandatory, as though the word, "shall" had been substituted for "should" wherever it appears. Equipment, materials, installation, and workmanship shall be in accordance with the mandatory and advisory provisions of NFPA 70 and NEMA unless more stringent requirements are specified or indicated.
- B. Where groups of luminaire types exhibit the same list of acceptable Manufacturers, such as downlights, accents, and wall washers, the intent is to have a final installation with the same Manufacturer's equipment across the groupings as specified for consistency of optics, aesthetics, and similarity of maintenance procedures. Mixing/matching across groups is unacceptable. This also applies to multi-phased projects with single or multiple, but related luminaire types exhibiting the same list of acceptable Manufacturers, except

where products have subsequently been discontinued or significantly redesigned in size, appearance, lamping, or gear. Lamps shall be from a single manufacturer and batch.

- C. Product procurement and coordination: Contractor shall:
1. Order products according to application.
 2. Confirm the proper and complete catalog number with distributor and agent.
 3. Ensure wiring, driver, etc meets the specifications and proper requirements.
 4. Provide additional parts and pieces required to complete the installation in the location and manner intended by the design.

1.10 COORDINATION

- A. Coordinate layout and installation of exterior lighting fixtures with all other construction including all underground utilities and geothermal well fields.
- B. Coordinate layout and installation of lighting fixtures with all other construction that penetrates ceilings or is supported by them, including HVAC equipment, plumbing, fire-suppression system and partition assemblies. Refer to Architects reflected ceiling plan (RCP) for locations of all ceiling devices.

1.11 PRODUCT DELIVERY, STORAGE AND HANDLING:

- 1.12 The Contractor shall provide, receive, unload, uncrate, store, protect and install lamps, luminaires and auxiliary equipment, as specified herein, in accordance with respective manufacturers' project conditions of temperature and humidity and with appropriate protection against dust and dirt. Lamps for miscellaneous equipment shall be provided and installed by the Contractor according to equipment manufacturers' guidelines. All products shall be stored in manufacturer's unopened packaging until ready for installation.

1.13 EXTRA MATERIALS

- A. Furnish the following extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing content:
1. LED Drivers: One (1) for every fifty (50) of each type and rating installed. Furnish at least five (5) of each type.
 2. LED Lamps/Boards: One (1) for every one-hundred (100) of each type and rating installed. Furnish at least two (2) of each type.

1.14 WARRANTIES

- A. The equipment items shall be supported by service organizations which are reasonably convenient (less than 100 miles from project site) to the equipment installation in order to render satisfactory service to the equipment on a regular and emergency basis during the warranty period of the contract.
- B. All luminaries, finishes, poles and all of its component parts, workmanship, and controls shall have an unconditional ten (10) year on-site replacement warranty. Warranty shall include all light fixtures, lamps, drivers, poles, finishes and all components to be free from defects in materials and workmanship for a period of ten (10) years from date of Owner's acceptance. On-site replacement includes transportation, removal, and installation of new products. Replacement of luminaries, faulty materials and the cost of labor to make the replacement shall be the responsibility of the Contractor.
- C. The Warranty specified in this Article shall not deprive the Owner of other rights the Owner may have under provisions of the Contract Documents and shall be in addition to and run concurrently with other warranties made by the Contractor under requirements of the Contract Documents.
- D. LED drivers: The warranty period shall not be less than ten (10) years from the date of substantial completion. The warranty shall state the malfunctioning LED driver shall be exchanged by the manufacturer and promptly shipped to the Owner. The replacement LED driver shall be identical to, or an improvement upon, the original design of the malfunctioning LED driver.

PART 2 - PRODUCTS:

2.1 MANUFACTURERS

- A. Subject to compliance with requirements, provide one of the products indicated on Light Fixture Schedule. Refer to Light Fixture Schedule for manufacturers and model numbers. Basis of Design for each light fixture type shall be the first fixture manufacturer and model number for each type listed. Refer to Specification Section 260501, paragraph EQUAL MANUFACTURERS for additional requirements.
- B. Manufacturer's catalog numbers together with the descriptions on the drawings and these specifications are indicative of required design, appearance, quality and performance. Report any discrepancies between any of these to the Engineer for resolution prior to bid. In absence of such notice to the Engineer, provide the greater requirement as directed by the Engineer, without additional cost.
- C. All luminaires shall be DLC (Design Lights Consortium) Certified.

2.2 GENERAL REQUIREMENTS FOR LUMINAIRES AND COMPONENTS: Comply with the requirements specified in the Articles below and the Light Fixture Schedule.

- A. Complete luminaires shall be in accordance with NFPA 70, NEMA, and UL 1598 listed and labeled.
- B. Ballasts, drivers, or transformers, unless otherwise specified, shall be field replaceable and shall be serviceable while the fixture is in its normally installed position, and shall not be mounted to removable reflectors or wireway covers unless so specified.
- C. Luminaires shall be entirely factory wired by the luminaire manufacturer in accordance with code and UL requirements and shall be furnished fully compatible with the project electrical wiring and controls system for smooth, continuous, dimming or on/off flicker-free operation.
- D. Exterior building mounted light fixtures shall be UL classified for damp or wet locations as applicable and shall be complete with gaskets, cast aluminum outlet box and grounding. All dissimilar metal materials shall be separated by non-conductive materials to prevent galvanic action.
- E. All luminaires supplied for recessing in suspended ceilings shall be supplied with pre-wired junction boxes, unless otherwise specified.
- F. Metal parts: Free of burrs, sharp corners and sharp edges.
- G. Doors, frames and other internal access: Smooth operating, free of light leakage under operating conditions. Designed to prevent doors, frames, lenses, diffusers and other components from falling accidentally during maintenance and when secured during operating position.
- H. Mounting Frames and Rings: If ceiling system and luminaire type requires, each recessed and semi-recessed luminaire shall be furnished with a mounting frame or ring compatible with the ceiling in which they are to be installed as coordinated by Contractor. The frames and rings shall be one piece and of sufficient size and strength to sustain the weight of the luminaire and maintain plumb. Luminaires shall be braced such that the force required to close and/or latch lens or door frame does not lift or shift luminaire.
- I. Pendant Supports: Contractor shall be responsible for coordination with Manufacturer, Architect, Structural Engineer and related trades to ensure that proper and adequate structural reinforcement is provided within ceilings to support pendant mounted lighting equipment for a secure, neat, square, plumb appearance. Pendants shall not sag, droop, snake or otherwise appear out of plumb or alignment in finished installation with lamps, globes, lenses, lens frames or doors etc. in place.
- J. Wall Bracket (Sconce) Supports: Contractor shall be responsible for coordination with Manufacturer, Architect, Structural Engineer and related trades to ensure that proper and adequate structural reinforcement is provided within walls to support wall mounted lighting equipment for a secure, neat, square, plumb appearance. Wall brackets shall not sag, droop, snake or otherwise appear out of plumb or alignment in finished installation with lamps, globes, lenses, lens frames or doors etc. in place.
- K. All lenses or other light diffusing elements shall be removable for access to lamp and electrical and electronic components and luminaire cleaning, however, they must otherwise be positively and securely held in-place, unless otherwise specified.

- L. All lens door or holder trim flanges shall fit plumb and flush with the ceiling or wall surface. There shall be no light leaks around the interface between lens door or holder trim flanges and the ceiling or wall.
- M. Recessed Fixtures: Comply with NEMA LE 4 for ceiling compatibility.
- N. Recessed luminaires mounted in an insulated ceiling shall be listed for use in insulated ceilings, IC-rated or provisions made to maintain code-compliant 3" air-space around luminaires in accordance with Manufacturers' instructions.
- O. Mechanical Safety: Unless otherwise specified, luminaire closures (lens doors, trim frame, hinged housings, etc.) shall be retained in a secure manner by captive screws, chains, captive hinges or fasteners such that they cannot be accidentally dislodged during normal operation or routine maintenance.
- P. Unless otherwise specified, luminaires with louvers or light transmitting panels shall have hinges, latches and safety catches to facilitate safe, convenient cleaning and re-lamping. Vapor tight luminaires shall have stainless steel pressure clamping devices.
- Q. Yokes, brackets and supplementary supporting members necessary for mounting lighting equipment shall be furnished and installed by the Contractor and approved by the Architect. All materials, accessories, and any other equipment necessary for the complete and proper installation of luminaires, lamps, ballasts/neon transformers included in the contract shall be furnished and installed by the Contractor. All yokes, brackets and supplementary supports shall provide a neat, square, plumb and level appearance, and shall not sag, droop, snake or otherwise appear out of plumb or alignment in finished installation with all lamps, globes, lenses, lens frames or doors etc. in place.
- R. All connections shall be fixed rigid by screws, rivets and/or soldering. Screws and rivets shall not be visible except as necessary for maintenance and/or aesthetic appearance. All connections shall provide a neat, square, plumb and level appearance, and shall not sag, droop, snake or otherwise appear out of plumb or alignment in finished installation with lamps, globes, lenses, lens frames or doors etc. in place.
- S. All sheet metal work shall be free from tool marks and dents and shall have accurate angles bent as sharp as compatible with the gauges of the required metal and the luminaire styling. All intersections and joints shall be formed true and of adequate strength and structural rigidity to prevent any distortion after assembly.
- T. For steel and aluminum luminaires, all screws, bolts, nuts and other fastening and latching hardware shall be a cadmium or equivalent plated. For stainless steel luminaires, all hardware shall be stainless steel. For all bronze luminaires, all hardware shall be bronze.
- U. Extruded aluminum frames and trims shall be rigid and manufactured from quality aluminum without blemishes in the installed product. Miter cuts shall be accurate; joints shall be flush and without burrs and cut alignment maintained with the luminaire located in its final position.
- V. Castings shall exactly replicate the approved pattern(s) and shall be free of sand pits, blemishes, scales and rust and shall be smoothly finished, excepted as necessary for an authentic historic appearance and as agreed by Architect. Tolerances shall be provided for any shrinkage in order that the finished castings accurately fit their locations resulting in plumb and level fit and consistently tight-seamed fittings.
- W. Outdoor Luminaires: Luminaires shall be suitably gasketed and vented according to manufacturer's instructions. All dissimilar metal materials shall be separated by non-conductive materials to prevent galvanic action.
- X. Luminaires in Hazardous Areas: Luminaires shall be suitable for installation in flammable atmospheres (Class and Group) as defined in NFPA 70 and shall comply with UL 844.
- Y. Each light fixture shall be packaged with complete instructions and illustrations on how to install.
- Z. Each light fixture box, container, etc shall be labeled at the factory with the type designation as indicated on the Light Fixture Schedule.
- AA. Fixture whips shall be 1/2" flexible, with clamp-on steel fittings at each end, six-foot maximum length, with insulated throat bushings at each end and bonding locknuts. Wiring thru fixture whips shall be #12 AWG, with #12 AWG ground bonded to outlet at source end.

- BB. All luminaires that are split-wired shall be provided with a permanently affixed lamacoid warning label on the ballast channel cover indicating two hot circuits present and indicating both normal and emergency power panel and circuit numbers.
- CC. Provide custom, factory cut stem lengths as required.
- DD. Contractor shall verify ceiling types prior to ordering fixtures and provide fixtures appropriate to the actual condition. This is to include specific type of lay-in ceiling grid.
- EE. Fixtures that are hatched shall have an integral 90-minute battery inverter.
- FF. All battery powered fixtures shall have test switches factory installed integral to the reflector. Remote test switches will not be accepted.

2.3 LUMINAIRE REFLECTORS AND TRIMS

- A. Alzak cones, reflectors, baffles and louvers shall be warranted against discoloration.
- B. All trims, reflectors and canopies shall fit snugly and securely to the ceiling or wall so that no light leak occurs.
- C. Trims shall be self-flanged, unless otherwise specified.
- D. For trimless or flangeless luminaires, Contractor shall coordinate with other Trades to achieve a trimless/flangeless installation acceptable to the Architect. Where ceilings are drywall or plaster, this involves Level 5 finishes or as otherwise directed by the Architect. In drywall, plaster, wood, or stone ceilings, special luminaire collars and exacting coordination are required of Contractor.

2.4 LIGHT EMITTING DIODE (LED) ELECTRONIC DRIVERS: The electronic driver shall at a minimum meet the following characteristics:

- A. LED drivers shall comply with NEMA SSL 1, NFPA 70, and UL 8750 unless otherwise specified.
- B. Drivers remote from luminaires shall be housed in NEMA enclosures so rated for the driver and located in code-compliant, sound-isolated, well-ventilated and easily accessible areas. Wire shall be sized according to run length and LED Manufacturer's size and distance-of-run requirements and all in accordance with all code requirements.
- C. Driver shall comply with UL 1310 Class 2 requirements for dry and damp locations, NFPA 70 unless specified otherwise. Drives shall be designed for the wattage of the LEDs used in the indicated application. Drivers shall be designed to operate on the voltage system to which they are connected.
- D. LED driver shall withstand up to a 1,000-volt surge without impairment of performance as defined by ANSI C62.41 Category A.
- E. LED driver shall tolerate ± 10 percent supply voltage fluctuation with no adverse effects to driver or LEDs.
- F. Drivers for luminaires controlled by dimming devices shall be as specified herein and equipped for dimming and conform to the recommendations of the manufacturer of the associated dimming devices to assure satisfactory operation of the lighting system. Contractor shall coordinate all wiring infrastructure to accommodate final-selected drivers and controls systems for smooth, continuous, and flicker-free operation.
- G. Flicker: The flicker shall be less than 5 percent at all frequencies below 1000 Hz and without visible flicker.
 - 1. Drivers shall meet or exceed NEMA 410 driver inrush standard.

2.5 LIGHT EMITTING DIODE (LED): The light emitting diodes shall as a minimum meet the following characteristic:

- A. LED lamps shall comply with ANSI C78.1.
- B. Light emitting diodes shall be tested under IES LM-80 standards.
- C. Color Rendering Index (CRI) shall be 80 (minimum).

2.6 SUSPENDED LUMINAIRES

- A. Provide hangers capable of supporting twice the combined weight of fixtures supported by hangers. Provide with swivel hangers to ensure a plumb installation. Hangers shall be cadmium-plated steel with a swivel-ball tapped for the conduit size indicated. Hangers shall allow fixtures to swing within an angle of 45 degrees. Brace pendants 4 feet or longer to limit swinging. Single-unit suspended fixtures shall have twin-stem hangers. Multiple-unit or continuous row fixtures shall have a tubing or stem for wiring at one point and a tubing or rod suspension provided for each unit length of chassis, including one at each end. Rods shall be a minimum 0.18 inch diameter.
- B. All suspended luminaires with a weight in excess of 150 pounds shall be fitted with safety cable of sufficient strength and length to meet all UL safety cable load-bearing requirements. Cable shall exhibit a finish (but not painted) compatible with that of the metal finish of the stem/chain/suspension-cable assembly or alternatively finished in black as approved by Architect. Shop drawings shall indicate luminaire weight. Contractor shall coordinate structural support/attachment requirements including independent structure for safety cable attachment with Vendor, Architect, and Structural Engineer and all respective trades. Safety cable shall exhibit sufficient length to wrap tightly and entirely around structural member at least twice before attachment subject to Vendor confirmation of UL requirements and pending Structural Engineer review. Contractor shall provide labor necessary for the stem/chain-assembly-wiring-threading and safety-cable-attachment as instructed by Vendor.

2.7 LUMINAIRE SUPPORT HANGERS AND COMPONENTS

- A. Wires: ASTM A641/A641M, Class 3, soft temper, galvanized regular coating, 0.1055 inches in diameter (12 gage).
- B. Straps: Galvanized steel, one by 3/16 inch, conforming to ASTM A653/A653M, with a light commercial zinc coating or ASTM A1008/A1008M with an electrodeposited zinc coating conforming to ASTM B633, Type RS.
- C. Rod Hangers: Threaded steel rods, 3/16 inch diameter, zinc or cadmium coated.

2.8 GENERAL REQUIREMENTS FOR POLES AND SUPPORT COMPONENTS

- A. Provide poles designed for site specific wind loading (minimum of 120 miles per hour) determined in accordance with AASHTO LTS while supporting luminaires and all other appurtenances indicated. The effective projected areas of luminaires and appurtenances used in calculations shall be specific for the actual products provided on each pole. Poles shall be anchor-base type designed for use with underground supply conductors. Poles shall have full base metal covers with matching finish.
- B. Structural Characteristics: Comply with AASHTO LTS
 - 1. Wind-Load Strength of Poles: Adequate at indicated heights above grade without failure, permanent deflection, or whipping in steady winds of speed indicated in "Structural Analysis Criteria for Pole Selection" Article.
 - 2. Strength Analysis: For each pole, multiply the actual equivalent projected area of luminaires and brackets by a factor of 1.3 to obtain the equivalent projected area to be used in pole selection strength analysis.
- C. Luminaire Attachment Provisions: Comply with luminaire manufacturers' mounting requirements. Use stainless-steel fasteners, unless otherwise indicated.
- D. Mountings, Fasteners, and Appurtenances: Corrosion-resistant items compatible with support components.
 - 1. Materials: Shall not cause galvanic action at contact points.
 - 2. Anchor Bolts, Leveling Nuts, Bolt Caps, and Washers: Hot-dip galvanized after fabrication unless otherwise indicated.
 - 3. Anchor-Bolt Template: Plywood or steel.
- E. Handhole: Oval-shaped, with minimum clear opening of 2-1/2 by 5 inches, with cover secured by stainless-steel captive screws.

- F. Pole Foundations: Cast in place, with anchor bolts to match pole-base flange. Anchor bolts shall be steel rod having minimum yield strength of 50,000 psi and shall be galvanized in accordance with ASTM A153/A153M. Concrete shall be as specified in Division 03 Specification Section, CAST-IN-PLACE CONCRETE.
- G. Breakaway Supports: Provide frangible breakaway supports where noted on plans, tested by an independent testing agency acceptable to authorities having jurisdiction, according to AASHTO LTS.
- H. Brackets and Supports
 - 1. ANSI C136.3, ANSI C136.13, and ANSI C136.21, as applicable. Pole brackets shall be not less than 1-1/4 inch secured to pole. Slip-fitter or pipe-threaded brackets may be used, but brackets shall be coordinated to luminaires provided, and brackets for use with one type of luminaire shall be identical. Brackets for pole-mounted street lights shall correctly position luminaire no lower than mounting height indicated. Mount brackets not less than 24 feet above street. Special mountings or brackets shall be as indicated and shall be of metal which will not promote galvanic reaction with luminaire head. Detachable, cantilever, without underbrace.
 - I. Cable Support Grip: Wire-mesh type with rotating attachment eye, sized for diameter of cable and rated for a minimum load equal to weight of supported cable times a 5.0 safety factor.
 - J. Grounding and Bonding Lugs: Welded 1/2-inch threaded lug, complying with requirements in Division 26 Section "Grounding and Bonding for Electrical Systems," listed for attaching grounding and bonding conductors of type and size listed in that Section, and accessible through handhole. Provide a pole grounding connection designed to prevent electrolysis when used with copper ground wire.
 - K. Finish: Same as luminaire.
- 2.9 FUSING: All luminaires shall be provided with fuse(s) and in-line fuse holder(s). Fuse pole mounted luminaires at handhole.
- 2.10 EQUIPMENT IDENTIFICATION
 - A. Manufacturer's Nameplate: Each item of equipment shall have a nameplate bearing the manufacturer's name, address, model number, and serial number securely affixed in a conspicuous place; the nameplate of the distributing agent will not be acceptable.
 - B. Factory-Applied Labels: Provide labeled luminaires in accordance with UL 1598 requirements. All light fixtures shall be clearly marked for operation of specific LED's and drivers according to proper type. The following characteristics shall be noted in the format "Use Only _____":
 - 1. LED or lamp type, and nominal wattage
 - 2. Driver type
 - 3. Correlated color temperature (CCT) and color rendering index (CRI)
 - 4. All markings related to lamp type shall be clear and located to be readily visible to service personnel, but unseen from normal viewing angles when lamps are in place. Drivers and ballasts shall have clear markings indicating multi-level outputs and indicate proper terminals for the various outputs.
- 2.11 FACTORY APPLIED FINISH: Electrical equipment shall have factory-applied painting systems which shall, as a minimum, meet the requirements of NEMA 250 corrosion-resistance test.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Architect's reflected ceiling plan (RCP) shows actual locations of all light fixtures, diffusers and system devices. Report to the Architect/Engineer any conflicts. Do not scale plans for exact location of lighting fixtures.
- B. Install luminaires in accordance with luminaire manufacturer's written instructions, applicable requirements of NEC, NECA's "Standard of Installation", and NEMA standards.

- C. Electrical installations shall conform to and meet IEEE C2, NFPA 70, and to the requirements specified herein.
- D. Installed luminaires shall be provided with protective covering by Contractor until such time as the space(s) is cleaned and ready for occupancy.
- E. Align, mount and level the luminaires uniformly. All luminaires shall be installed plumb/true and level as viewed from all directions. Luminaires shall remain plumb and true without continual adjustment.
- F. Set luminaires plumb, square, and level with ceiling and walls, in alignment with adjacent lighting fixtures, and secure in accordance with manufacturers' directions and approved drawings. Obtain approval of the exact mounting for lighting fixtures on the job before commencing installation and, where applicable, after coordinating with the type, style, and pattern of the ceiling being installed.
- G. Recessed, semi-recessed and surface fixtures shall be independently supported from the buildings structure. Ceiling grid clips are not allowed as an alternative to independently supported light fixtures. Round fixtures or fixtures smaller in size than the ceiling grid shall be independently supported from the building structure by a minimum of four wires per fixture spaced approximately equidistant around the fixture. Do not support fixtures by ceiling acoustical panels. Where fixtures of sizes less than the ceiling grid are indicated to be centered in the acoustical panel, support such fixtures independently and provide at least two 3/4 inch metal channels spanning, and secured to, the ceiling tees for centering and aligning the fixture. Provide wires for lighting fixture support in this section. Lighting fixtures installed in suspended ceilings shall also comply with the requirements of Division 09 Specification Sections GYPSUM BOARD, ACOUSTICAL PANEL CEILINGS and SUSPENDED DECORATIVE WOOD GRIDS. Support lay-in ceiling light fixtures as follows:
 - 1. Support fixtures with four (4) wires, with one (1) at each corner. Hanger wires shall be installed within 15 degrees of plumb or additional support shall be provided. Wires shall be attached to fixture body and to the building structure (not to the supports of other work or equipment).
 - 2. Where building structure is located such that 15 degrees cannot be maintained, the Contractor shall provide "Uni-strut" or similar structure to meet this requirement.
 - 3. Support Clips: All fixtures shall be furnished with hold down clips to meet applicable seismic codes. Provide four (4) clips per fixture minimum or the equivalent thereof in the installation trim. Fasten to light fixtures and to ceiling grid members at or near each fixture corner with clips that are UL listed for the application. Contractor shall install clips per manufacturer's requirements. If screws are required, they shall be provided.
- H. Lighting Fixture Supports:
 - 1. Shall maintain the fixture positions after cleaning and re-lamping.
 - 2. For installation in suspended ceilings, ensure that the luminaires are supported such that there is no resultant bowing or deflection of the ceiling system.
- I. Downlights, exit signs and battery pack supported by or attached to ceiling grid or tile shall be provided with one hanger wire at each end. Provide a minimum of two, located at opposite corners. Hanger wires shall be installed within 15° of plumb, maximum or additional support shall be provided. Wires shall be attached to the fixture body and to the building structure and not to the supports of other work or equipment.
- J. Luminaires installed and used for working light during construction shall be replaced prior to turnover to the Owner if more than 3 percent of their rated life has been used. Fixtures shall be tested for proper operation prior to turn-over and shall be replaced if necessary with new lamps from the original manufacturer.
- K. Suspended fixtures shall hang plumb and shall be located with no obstructions within the 45 degree range in all directions. The stem, cable, canopy and fixture shall be capable of 45 degree swing. Suspended fixtures in continuous rows shall have internal wireway systems for end to end wiring and shall be properly aligned to provide a straight and continuous row without bends, gaps, light leaks or filler pieces. Aligning splines shall be used on extruded aluminum fixtures to assure hairline joints. Steel fixtures shall be supported to prevent "oil-canning" effects. Fixture finishes shall be free of scratches, nicks, dents, and

warps, and shall match the color and gloss specified. Pendants shall be finished to match fixtures. Aircraft cable shall be stainless steel. Canopies shall be finished to match the ceiling and shall be low profile unless otherwise shown.

- L. Whenever a luminaire or its hanger canopy is installed directly to a surface mounted junction box, a finishing ring painted to match the ceiling, shall be used to conceal the junction box.
- M. Rigidly align continuous rows of light fixtures for true in-line appearance.
- N. Emergency Lighting Units: Wire lights ahead of the switch to the un-switched branch circuit located in the same room or area.
- O. Light fixture whips shall be supported from the building structure. Do not clip to lay-in ceiling support wires.
- P. Exterior Fixtures:
 - 1. Exterior building mounted light fixtures shall not be installed until after the building exterior has been rinsed clean of any corrosive cleaning materials. Damaged fixtures shall be replaced by the Contractor at no cost.
 - 2. Provide exterior rated weather proof junction boxes for all fixtures and splices.
 - 3. Utilize weatherproof silicone filled wire nuts and seal all junction boxes and conduit with potting compound to create waterproof barriers. Inspect all splices and fixtures for continuity prior to potting.
 - 4. Lubricate all threaded parts with a high temperature waterproof anti-seize lubricant to prevent seizing and corrosion.
 - 5. All low-voltage wiring to be UV resistant, UL approved for use without conduit, stranded low-voltage wire (Q-Wire by Q-Tran or equal) for use in outdoor and underground applications, gauge as appropriate to avoid voltage drop.
- Q. Transformers (applies to all transformers including (but not limited to) low voltage, neon, remote ballast, LED power supplies, exterior locations):
 - 1. Electrical Contractor to locate all transformers (including low voltage, neon, remote ballasts, led power supplies, etc.) near fixtures in a well-ventilated and accessible location. Transformers must be installed (per codes) in accessible areas large enough to dissipate the heat of the transformer. Temperatures should not exceed 100°F (38°C) or that required by manufacturer if more stringent.
 - 2. Electrical Contractor to determine wire size according to load and wire length to eliminate voltage drop. If voltage drop is a problem after installation, the Electrical Contractor is responsible for reinstallation (at no additional cost) of transformer and wire to solve problem.
 - 3. Electrical Contractor to label front of transformer/driver. Example: "Large Display Case @ Entry to Main Dining Room."
- R. Light fixture locations in mechanical and electrical equipment rooms/areas are approximate. Locate light fixtures to avoid equipment, ductwork, and piping. Locate around and between equipment to maximize the available light. Coordinate mounting heights and locations of light fixtures to clear equipment. Request a meeting with the Engineer if uncertain about an installation.
- S. Contractor shall be responsible for sealing all luminaires for wet and damp locations (i.e. all knock-outs, all pipe and wire entrances, etc.) to prevent water wicking.
- T. Coordinate between the electrical and ceiling trades to ascertain that approved luminaires are furnished in the proper sizes, with the proper flange details, and installed with the proper devices (hangers, clips, trim frames, flanges), to match the ceiling system being installed.
- U. All reflecting surfaces, glass or plastic lenses, ballast housings, parabolic louvers, downlighting alzak cones and specular reflectors and other decorative elements shall be installed after completion of ceiling tile installation, plastering, painting and general cleanup.
- V. Handle all reflecting surfaces, glass or plastic lenses, ballast housings, parabolic louvers, downlighting alzak cones and specular reflectors and other decorative elements with care during installation or lamping to avoid fingerprints or dirt deposits.

3.2 GROUNDING

- A. Bond luminaires and metal accessories to the grounding system per National Electrical Code.
- B. Ground noncurrent-carrying parts of equipment including metal poles, luminaires, mounting arms, brackets, and metallic enclosures. Where copper grounding conductor is connected to a metal other than copper, provide specially treated or lined connectors suitable for this purpose.

3.3 IDENTIFICATION

- A. Light fixtures served from multiple power sources, such as emergency fixtures fed from emergency transfer relay, shall have the following label affixed to it: "DANGER - ELECTRICAL SHOCK HAZARD - LIGHT FIXTURE HAS MULTIPLE POWER SOURCES"

3.4 CLEANING

- A. At completion of each phase and the time of final acceptance by the Owner, all lighting fixtures shall have been thoroughly cleaned with materials and methods recommended by the manufacturer.
- B. All fingerprints, dirt, tar, smudges, drywall mud and dust, etc. shall be removed by the Contractor from the luminaire bodies, reflectors, trims, and lens/louvers prior to final acceptance. Cleaned with solvent recommended by the manufacturer to a like-new condition or replaced. All reflectors shall be free of paint other than factory-applied, if any.

3.5 TESTING AND ADJUSTMENT

- A. The lighting and lighting controls systems shall be synchronized and fully operable to address the lighting operation in a complete and code-compliant manner.
- B. All adjustable luminaires shall be aimed, focused, locked, etc., by the Contractor under the observation of the Architect and Engineer. As aiming and adjusting is completed, locking setscrews and bolts and nuts shall be tightened securely by the Contractor. All aiming and adjusting shall be performed after the entire installation is complete for each phase or area. The Contractor shall be responsible for notifying the Architect of appropriate time for final luminaire adjustment. Where possible, units shall be focused during the normal working day. However, where daylight interferes with seeing lighting effects, aiming shall be accomplished at night at no premium cost.
- C. All ladders, scaffolds, lifts, gloves, cleaning cloths, access/adjustment tools, etc. required for aiming and adjusting luminaires shall be furnished by the Contractor.
- D. Replace defective lamps and drivers.

3.6 FIELD QUALITY CONTROL:

- A. Upon completion of installation, verify that equipment is properly installed, connected, and adjusted. Conduct an operating test to show that equipment operates in accordance with requirements of this section.
- B. Illumination Observations: Verify normal operation of lighting units after installing luminaires and energizing circuits with normal and emergency power sources.
- C. Dimming Drivers. Test for full range of dimming capability. Observe for visually detectable flicker over full dimming range.
- D. Test for Emergency Lighting: Interrupt power supply to demonstrate proper operation. Verify transfer from normal power to battery and retransfer to normal.
- E. Inspect each light fixture for damage. Replace damaged light fixtures at no cost to the Owner.
- F. Fixtures showing dirt, dust or fingerprints shall be restored to like new condition or shall be replaced at no cost.

3.7 ADJUSTING

- A. Occupancy Adjustments: When requested within 12 months of date of Completion, provide on-site assistance in adjusting aimable luminaires to suit actual occupied conditions. Provide up to two (2) visits to Project during other-than-normal occupancy hours for this purpose. Some of this work may be required after dark.
1. Adjust aimable luminaires in the presence of Architect/Engineer.

END OF SECTION 265000