Project Manual and Specifications

McCreary County Spec Building Fit-Up

for the

McCreary County Industrial Development Authority Pine Knot, Kentucky

MSE Project Number: 2096-06

December 2023

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Sealed bids for the construction fit-up of the approximately 32,592 s.f. existing Speculative Building in Pine Knot, KY and all work shown in the contract documents will be received on behalf of the McCreary County Industrial Development Authority (MCIDA) for the McCreary Co. Spec. Building Fit-up in Pine Knot, KY, will be received in the office of the McCreary Co. Fiscal Court on behalf of MCIDA, at 2 North Main St., Whitley, KY 42653 (606-376-2413) until 2:00 p.m., local time, February 6, 2024 and then at said office will be publicly opened and read aloud. General Contractor must follow all guidelines. Faxed or electronic bids will not be accepted.

The CONTRACT DOCUMENTS may be reviewed at the following locations: MSE Web Site: mselex.com under Bid Opportunities.

All Contract Documents and Addenda will be posted on our web page, mselex.com under Bid Opportunities and will not be sent to plan holders by MSE of Kentucky, Inc.

Copies of the Contract Documents may be obtained at the office of Lynn Imaging, 328 E. Vine St., Lexington, KY 40507, (859) 226-5850 upon receipt of a check made payable to Lynn Imaging in the amount of \$150.00 (non-refundable). All orders must be prepaid. There will be a 24-hour turn-around on all orders.

A certified check or bank draft, payable to McCreary Co. Industrial Development Authority, government bonds, or a satisfactory bid bond executed by the bidder and acceptable sureties in an amount equal to five percent of the bid shall be submitted with bid. The successful bidder will be required to furnish and pay for the following: 1) 5% Bid Bond; and 2) A performance and payment bond for 100% of the contract price.

Attention of bidders is particularly called to the requirements as to conditions of employment to be observed and minimum wage rates to be paid under the contract, Section 3, Segregated Facility, Section 109 and E.O. 11246 and Title VI and other requirements. Minority bidders are encouraged to bid.

The Owner may consider informal any bid not prepared and submitted in accordance with the provisions of this advertisement and/or the specifications and may waive any informalities or reject any and all Bids. Any proposal received after the time and date specified shall not be considered and will be returned unopened to the proposer. The owner reserves the right to waive any informalities or to reject any or all bids.

Sealed bid should be labeled "McCreary Co. Spec. Building Fit-up for MCIDA".

Federal Wage Rates do not apply to this project.

No Bidder may withdraw his Bid for a period of sixty (60) days after the actual date of the opening thereof.

Award will be made to the lowest, responsive, responsible bidder. Bidding is for the sole benefit of the MCIDA. The MCIDA is an Equal Employment Opportunity Employer.

End of Section

SECTION 00100 - INSTRUCTIONS TO BIDDERS ADDITIONAL INFORMATION

PART 1 - GENERAL

1.01 DEFINITIONS

- A. AIA Document A701/1997, Instructions to Bidders, Articles 1 through 8, inclusive, is a part of this Contract.
- B. General Conditions of the Contract for Construction, AIA Document A201/2007 or current edition, Articles 1 through 14 inclusive, are a part of this Contract.

1.02 BIDDING DOCUMENTS

- A. The Bidding Documents are the Bidding and Contract Requirements, the Specifications, the Drawings and any addenda issued prior to receipt of bids.
- B. Documents are on file and may be examined or obtained for bidding purposes as stated in Section 00020 Advertisement for Bids.

1.03 SUBSTITUTIONS AND APPROVALS DURING BIDDING

- A. Whenever products or materials are specified as "Standards" or they are otherwise named, approval of other equal quality products shall be obtained by requesting in writing and presenting for evaluation, such product or material, to the Architect, no later than seven (7) days prior to date set for receipt of bids. Submittals circumventing the above time frame will not be processed.
 - 1. If approval is granted, product or material will be added by Addendum.
 - 2. No direct reply will be made to any requests for changes, but any requested changes approved by the Architect will be stated in an Addendum issued to all prime-bidders.
 - 3. Issuance of Bidding Documents does not constitute approval of products, materials, or subcontractors.

1.04 ADDENDA

Article 3: Bidding Documents. 3.4 Addenda, 3.4.3. Change the four days to read as follows: Addenda will be issued by the Architect when in the opinion of the Architect the issuance of an addenda is in the interest of the bid process and the Owner.

1.05 BIDDER'S REPRESENTATION

A. Each Bidder, by making his bid, represents that he has read and understands the bidding documents.

- B. Each Bidder, by making his bid, represents that he has familiarized himself with the local conditions under which the Work is to be performed.
 - 1. No additional costs of any type will be allowed by the failure of the Bidder to avail himself of the privilege of a complete and thorough, on-site inspection.
- C. Each bidder must visit and inspect the site.

1.06 BID SECURITY

- A. Provide bid security in the form of Bid Bond, AIA Documents A310, for five percent (5%) of bid made payable to the <u>McCreary County Industrial Development Authority</u>. This security shall be forfeited if the bidder is awarded the contract and subsequently fails to enter into a contract with and furnish the required contract bond to the OWNER within ten (10) days after notice of acceptance of his proposal is made.
- B. The bid security of all unsuccessful bidders will be returned promptlyafter an award has been made, or in the event that all bids are rejected. The bid security of the successful bidder will be returned when a satisfactory performance and labor and material payment bond has been furnished and the contract executed.

1.07 PREPARATION OF BIDS

- A. Bids shall be submitted in duplicate only on proposal bid form as included herein.
- B. Any interlineation, alteration, or erasure will be grounds for rejection of the Bid. Bids shall contain no recapitulation of the work to be done.
- C. Bids shall be based on the materials, construction, equipment and methods named or described in the specifications and on the drawings, and any addenda issued prior to receipt of bids.
- D. Proposals shall be sealed in an opaque envelope marked with the bidder's name and business address, and bearing the following caption:
 - Proposal for: McCreary County Spec. Building Fit-Up for the McCreary County Industrial Development Authority (MCIDA)
 - Proposals shall be addressed and delivered to: McCreary Co. Fiscal Courtroom (C/O MCIDA) 2 North Main St., Whitley, KY 42653

1.08 BID SUPPLEMENTS

- A. Bids shall be accompanied by the following supplemental documents, all properly signed and notarized:
 - 1. Bid Security, Bid Bond, AIA Document A310
 - 2. Document SC-1 Subcontractors List (may use your own form)
 - 3. Document PC-1 Project Cost Breakdown (may use your own form)
 - 4. Non-Collusion Affidavit

1.09 SELECTION OF BIDS

A. The Owner reserves the right to reject any and/or all bids and to waive any informality in bidding.

1.10 AWARD OF CONTRACTS

A. Contracts shall be deemed to have been awarded when Notice of Award shall have been duly served upon the Bidder by any officer or agent of the Owner duly authorized to give such notice. Before the contract becomes valid, the Bidder must provide all necessary bonds, insurance and other information herein called for.

1.11 THE SUCCESSFUL BIDDER WILL BE REQUIRED TO FURNISH THE FOLLOWING:

- A. A One Hundred Percent (100%) Performance/Payment Bond, in an amount equal to the total contract price. This bond shall guarantee all labor and materials to be as required, the faithful performance of the contract and the prompt and faithful payment of any claim or liens form any cause for which the Contractor is liable, including those for labor, materials, utility services, transportation costs and for supplies, equipment and machinery (or rental thereof).
- B. Such guarantee bonds shall remain in effect and full force for one (1) year after final acceptance of the work. Such bond shall not be executed as of a date prior to the executing of the contract.

1.12 DETAILED COST BREAKDOWN

A. Upon award of contract, Contractor will have seven (7) working days to generate a finalized detailed cost breakdown and a detailed project schedule of the project. All construction draws made on the project will require updating the Contractor's cost breakdown. Architect and Owner approval will be required on all pay requests.

1.13 CONTRACTOR'S RESPONSIBILITY REGARDING SUB-CONTRACTORS

A. It shall be prime contractor's responsibility to check all sub-bids carefully to determine whether or not any exceptions, omissions, or alterations to the drawings and specifications have been noted therein, as he is solely responsible for a complete job in strict accordance with drawings and specifications.

1.14 COMMENCING WORK

A. Contractor shall commence work within ten (10) days after written Notice to Proceed is issued by the Owner, unless otherwise arranged by the Owner.

1.15 OCCUPATIONAL SAFETY AND HEALTH ACT OF 1970

- A. These construction documents are to be governed, at all times, by applicable provisions of the federal laws, including but not limited to the latest amendments of the following:
 - 1. William Steiger Occupational Safety and Health Act of 1970, Public Law 91-596.
 - 2. Part 1910 Occupational Safety and Health Standards, Chapter XVII of Title 29, Code of Federal Regulations.
- B. All prime contractors, sub-contractors and their employees shall be solely responsible to conduct their work in conformance with the regulations contained in this act and as amended. All material suppliers and manufacturers shall be fully aware of their responsibilities and the requirements of the finished project under the regulations of this Act, and as amended. Such materials and fabricated products incorporated in this project shall, at the time of installation or application, be in conformance with the regulations of this act, and as amended.

SECTION 00310 - BID SCHEDULE

Proposal of	(hereinafter called
"BIDDER"), organized and existing under the laws of the State of	doing
business as	*
to the McCreary Co. Industrial Development Authority (hereinafter called "OW	VNER").

In compliance with your Advertisement for Bids, BIDDER hereby proposes to perform all WORK for the <u>McCreary Co. Spec Building Fit-up</u> in strict accordance with the Contract Documents,

within the time set forth and the prices stated below.

By submission of this BID, each BIDDER certifies, and in the case of a joint BID, each party thereto certifies as to its own organization, that this BID has been arrived at independently, without consultation, communication, or agreement as to any matter relating to this BID with any other BIDDER or with any competitor.

BIDDER hereby agrees to commence Work under this contract on or before a date to be specified in the Notice to Proceed and to complete the Project within two hundred and ten (210) consecutive calendar days following the Notice to Proceed. BIDDER further agrees to pay as liquidated damages, the sum of \$500.00 for each consecutive calendar day thereafter as provided in the General Conditions and the Special Conditions.

BIDDER agrees to perform all the WORK described in the CONTRACT DOCUMENTS for the lump sum contained in the following Bid Schedule.

*Insert "a corporation", "a partnership", or "an individual" as applicable.

Item	Description	Unit	Cost of Item
1.	Architectural and Structural Items	LS	\$
2.	Mechanical/Plumbing Items	LS	<u>\$</u>
3.	Electrical Items	LS	<u>\$</u>
4.	All Other Miscellaneous Costs	LS	<u>\$</u>
	TOTAL C	OST OF ITEMS 1 - 4	<u>\$</u>

The bid prices shall include all labor, materials, overhead, profit, insurance, and other costs necessary to install the finished work of the several items called for. Changes shall be processed in accordance with the General Conditions.

This is an invitation for offer to bid, not an offer to enter into a contract.

Accompanying this Proposal is a certified check or standard Bid Bond in the sum of _______ Dollars (\$______), in

accordance with the Information for Bidders. The BIDDER, by submittal of this Bid, agrees with the OWNER that the amount of the bid security deposited with this Bid fairly and reasonably represents the amount of damages the OWNER will suffer due to the failure of the BIDDER to fulfill his agreements as provided in this Proposal.

Addenda to the Drawings and Specifications issued heretofore are hereby acknowledged by the undersigned as being:

 No.
 Date:
 No.
 Date:

 No.
 Date:
 No.
 Date:

BIDDER understands that the OWNER reserves the right to reject any or all Bids and to waive any informalities in the Bidding.

BIDDER agrees that this Bid shall be good and may not be withdrawn for a period of sixty (60) calendar days after the actual date of bid opening.

Within ten (10) calendar days after receiving written notice of the acceptance of this Bid by the OWNER, the Bidder will execute and deliver to the OWNER four (4) copies of the Agreement and such other required Contract Documents.

BIDDER:		
	(Name of Company or Partnership)	
By:		
·	(Signature)	(Date)
	(Print Name)	(Title)
	()	()
	(Street Address/P.O. Box)	(Phone Number)
	(City, State, Zip)	
	(Email Address)	
Attested By:		
	(Signature)	(Date)
Seal (If bid is by a co	orporation)	
Seal (II bid is by a co	prporation)	

-

SECTION 00410 - BID SECURITY FORM

PART 1 - GENERAL

1.01 DESCRIPTION

- A. Bid security for this project shall be in the form of a Bid Bond executed on <u>AIA Document</u> <u>A310</u> form in the amount of five percent (5%) of the bid, made payable to the Owner.
 - 1. The bid security of all unsuccessful bidders will be returned promptly after an award has been made or in the event that all bids are rejected. The bid security of the successful bidder will be returned when satisfactory performance and labor and material payment bonds (AIA Document A312) have been furnished and contract executed, including one year warranty period.

SECTION 00480 - NON-COLLUSION AFFIDAVIT

PART 1 - GENERAL

1.01 DESCRIPTION

- A. The Non-Collusion Affidavit for the project shall be submitted with the bid proposal, and a copy of this document is bound herewith.
 - 1. When properly executed, this Document shall become a part of the successful bidder's Contract Document.

NON-COLLUSION AFFIDAVIT

The undersigned bidder, on behalf of its officers and agents or representatives being duly sworn, states that it has not in any way, directly or indirectly, entered into any arrangement or agreement with any other bidder, or with any other person or public officer whereby bidder has paid or is to pay to such other bidder or other person or public officer any sum or money, or has given of is to give to such other bidder or other person or public officer anything of value whatever, or such avant or affiants or either of them has not, directly or indirectly, entered into any arrangement or agreement with any other bidder or bidders, which tends to or does lessen or destroy free competition in the letting of the contract sought for by the attached bids; that no inducement of any form or character other than that which appears upon the face of the bid will be suggested, offered, paid or delivered to any person whomsoever to influence the acceptance of the said bid or awarding of the contract, nor has this bidder any agreement or understanding of any kind whatsoever, with any person whomsoever to pay, deliver to, or share with any other person in any way or manner, any of the proceeds of the contract sought by this bid.

Subscribed and sworn to before me by______this _____this _____therefore me by______therefore me by_____therefore me by______therefore me by______therefore me by_____therefore me by____therefore me by___therefore me by____

My Commission expires:

Notary Public

END OF AFFIDAVIT

SECTION 00490 - NOTICE OF AWARD

To:

Project Description: McCreary Co. Spec. Building Fit-up for MCIDA

The Owner has considered the Bid submitted by you for the above, described Work in response to its Advertisement for Bids dated ______ and Information for Bidders.

You are hereby notified that your Bid has been accepted for items in the amount of \$_____.

You are required by the Information for Bidders to execute the Agreement and furnish the Required Contractor's Performance Bond, Payment Bond and certificates of insurance within ten (10) calendar days from the date of this Notice to you.

If you fail to execute said Agreement and to furnish said Bonds within ten (10) days from the date of this Notice, said Owner will be entitled to consider all your rights arising out of the Owner's acceptance of your Bid as abandoned and as a forfeiture of your Bid Bond. The Owner will be entitled to such other rights as may be granted by law.

You are required to return an acknowledged copy of this Notice of Award to the Owner.

Dated this day of , 2024.

McCreary Co. Industrial Development Authority Owner

By:

(Name/Title)

ACCEPTANCE OF NOTICE

Receipt of the above NOTICE OF AWARD is hereby acknowledged by ______ this the

_____ day of _____, 2024.

By:

(Name/Title)

SECTION 00500 - AGREEMENT

THIS AGREEMENT, made this ______ day of _____, 2024, by and between the McCreary County Industrial Development Authority, hereinafter called "OWNER" and ______, doing business as a corporation (insert "a corporation", "a partnership", or "an individual" as applicable) hereinafter called "CONTRACTOR".

WITNESSETH: That for and in consideration of the payments and agreements hereinafter mentioned:

- 1. The CONTRACTOR will commence and complete all work as specified or indicated in the Contract Documents for the McCreary County Spec Building Fit-up.
- 2. The CONTRACTOR will furnish all of the material, supplies, tools, equipment, labor and other services necessary for the construction and completion of the project described herein.
- 3. The CONTRACTOR will commence the work required by the contract documents within 10 calendar days after the date of the Notice To Proceed and will complete the same within 210 calendar days unless the period for completion is extended otherwise by the Contract Documents. The CONTRACTOR further agrees to pay as liquidated damages, the sum of \$500 for each consecutive calendar day thereafter as provided in the Specifications.
- 4. The CONTRACTOR agrees to perform all of the work described in the Contract Documents and comply with the terms therein for the sum of \$______, or as shown in the Bid Schedule.
- 5. The term "CONTRACT DOCUMENTS" means and includes the following:
 - A. Invitation to Bid
 - B. Information for Bidders
 - C. Bid Form
 - D. Bid Bond
 - E. Agreement
 - F. Performance Bond
 - G. Payment Bond
 - H. Notice of Award
 - I. Notice to Proceed
 - J. General Conditions
 - K. Administrative Provisions
 - L. Labor Regulations and Wage Rates (If Applicable)
 - M. Technical Specifications
 - N. Drawings and Plan Sheets
 - O. Addenda
- 6. The project has been designed by MSE of Kentucky, Inc. who will act as ARCHITECT in connection with completion of the project in accordance with the Contract Documents.
- 7. CONTRACTOR shall submit Applications for Payment in accordance with the General Conditions. Applications for Payment will be reviewed by the ARCHITECT as provided in the General Conditions.

- 8. OWNER shall make progress payments on account of the Contract Price on the basis of CONTRACTOR'S Application for Payment as approved by the ARCHITECT, on or about the ______ of each month during construction as provided in the General Conditions. All progress payments will be on the basis of the progress of work measured by the schedule of values provided for in the General Conditions. Progress Payments, retainage, and withheld payments shall all be done in compliance with the General Conditions. Upon final completion of the work and settlement of all claims, OWNER shall pay the remainder of the Contract Price.
- 9. Neither OWNER nor CONTRACTOR shall, without the prior written consent of the other, assign or sublet in whole or in part his interest under any of the Contract Documents; and, specifically, CONTRACTOR shall not assign any moneys due or to become due without the prior written consent of the OWNER.
- 10. OWNER and CONTRACTOR each bind himself, his partners, heirs, executors, administrators, successors, assigns and legal representatives to the other party hereto in respect to all covenants, agreements and obligations contained in the Contract Documents.

IN WITNESS WHEREOF, the parties hereto have executed, or caused to be executed by their duly authorized officials, the Agreement in four (4) copies, each of which shall be deemed an original on the date first above written.

McC	Creary County Indust Authorit	rial Development y		
	(Owner)		(Contracto	or)
By:			Ву:	
	(Signature)	(Date)	(Signature)	(Date)
(Name, Title)			(Name, Title	e)
Attest	:		Attest:	
By:			Ву:	
	(Signature)	(Date)	(Signature)	(Date)
	(Name, Ti	tle)	(Name, Title	e)

End of Section

SECTION 00610 - PERFORMANCE BOND AND LABOR AND MATERIAL PAYMENT BOND

PART 1 - GENERAL

1.01 DESCRIPTION

- A. A performance bond for 100% of the final contract amount shall be executed in favor of the Owner; the forms for this bond shall be <u>AIA Document A 312</u>, "Performance Bond", 2010 edition.
- B. A Payment Bond on part of the contractor for 100% of the contract price as it may be increased, the forms for this bond shall be, <u>AIA Document A312</u>, "Payment Bond", 2010 edition.
- C. Consent of Surety to Reduction in or Partial Release of Retainage: <u>AIA Document G707A</u>, 1994 Edition.
- D. Consent of Surety to Final Payment: <u>AIA Document G707</u>, 1994 Edition.
- E. Furnish the required bonds within seven (7) days of receipt of Notice of Award.
- F. When fully executed, these bonds shall become part of the successful bidder's Contract Documents.
- G. Application and Certificate for Payment: <u>AIA Document G702 and G703</u>, 1992 Edition.
- H. Contractors Affidavit of Payment of Debts: <u>AIA Document G706</u>, 1994 Edition.
- I. Contractors Affidavit of Release of Liens: <u>AIA Document G706A</u>, 1994 Edition.
- J. Certificate of Substantial Completion: AIA Document G704, 2017 Edition.

SECTION 00650 - CERTIFICATES OF INSURANCE

PART 1 - GENERAL

1.01 GENERAL

- A. Certificates of Insurance shall be filed with the Owner prior to the commencement of any work. Insurance shall be purchased by the General Contractor.
 - 1. These certificates shall contain a provision that coverages afforded under the policies shall not be canceled or in any way terminated until at least thirty days prior written notice has been given to the Owner and Architect.
 - 2. The Owner and the Architect shall be specifically named as additional insureds on all insurance coverage for this project.
- B. Detailed insurance requirements are covered in Section 00800 Supplementary General Conditions, and all certificates shall reflect these minimum requirements for the project.

SECTION 00680 - NOTICE TO PROCEED

ТО:	Date:
	Project: McCreary Co Spec Building Fit-up
You are hereby notified to com	mence WORK in accordance with the Agreement dated,
on or before,	and you are to complete the WORK within_consecutive calendar
days thereafter. The date of con	mpletion of all WORK is therefore
	Owner
	Signature
	Name/Title
	ACCEPTANCE OF NOTICE
Receipt of the above NOTICE	TO PROCEED is hereby acknowledged by
this the	day of, 2024.

Contractor

Signature

Name/Title

SECTION 00800 - SUPPLEMENTAL CONDITIONS

PART 1 - GENERAL

1.01 DESCRIPTION

A. The "General Conditions of the Contract for Construction," AIA Document A201, fifteenth edition, 1997, Articles 1 through 14, inclusive, is a part of this Contract.

1.02 SUPPLEMENTS

A. The following supplements modify, change, delete or add to the "General Conditions of the Contract for Construction." Where any Article, Paragraph, Sub-Paragraph or Clause thereof is modified or deleted by these supplements, the unaltered provisions of that Article, Paragraph, SubParagraph or Clause shall remain in effect.

PART 2 - ARTICLE 2: OWNER

2.01 2.2 INFORMATION AND SERVICES REQUIRED OF THE OWNER

2.2.5 The Contractor can download pdf's from mselex.com. MSE will not furnish the Contractor any sets of drawings or project manuals for their use during construction.

PART 3 - ARTICLE 3: CONTRACTOR

3.01 REVIEW OF CONTRACT SUB-PARAGRAPHS

- A. Add the following sub-paragraphs:
 - 322 The Contractor shall not perform any work at any time requested by persons other than the Architect. Any interpretations to the documents, or request for minor changes in the work will be by the Architect.
 - 323 Where there is a conflict in or between the Drawings and Specifications, the Contractor shall be deemed to have estimated on the more expensive way of doing the work and/or the larger quantity required. Only changes in interpretations covered by Addenda or in writing from the Architect will be permitted during construction of the work.

3.02 WARRANTY

- A. Add the following sub-paragraph:
 - 3.5.2 General Contractor shall guarantee the work for a period of one year from the date of acceptance by the Owner, except where a longer guarantee is specified and will thus control and leave the work in perfect order at completion. Neither the final certificate of payment any provision in the Contract Documents shall relieve the Contractor of responsibility within the extent and period provided by said guarantee or by law whichever is longer. Upon written notice, he shall remedy any damage to other work resulting therefrom, including necessary labor for removing and replacing.

PART 4 - ARTICLE 8: TIME OF COMPLETION AND LIQUIDATED DAMAGES

See the Bid Schedule, Section 00310, for the time allotted for this contract. The time allowed for completion shall begin at midnight, local time, on the date which the Owner shall instruct the Contractor, in writing, to start work, but not later than 7 days after Notice to Proceed.

The Contract completion time stipulated above includes an allowance for an average number of inclement weather days as follows:

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
Precip.	7	7	9	8	8	8	8	7	6	5	6	7
Freeze	10	6	1								1	5

When number of days (including Saturdays, Sundays and Holidays) of precipitation in excess of 0.1" per day or maximum daily temperatures of 32 F exceed those shown above in any month, the Contractor shall be entitled to an equal number of additional days for Contract Completion.

This provision for inclement weather shall only apply to that time while foundations are being constructed and prior to the building being "under-roof".

It is understood that time is the essence of this contract and that the Owner will sustain damages, monetary and otherwise, in the event of delay in completion of the work hereby contracted.

Therefore, if the said Contractor shall neglect, fail or refuse to complete the work within the time herein specified, or any proper extension thereof granted by the Owner, then the Contractor does hereby agree, as part consideration for the awarding of this contract, to pay the Owner the amount specified in the contract, not as a penalty, but as liquidated damages for such breach of contract as hereinafter set forth, for each and every calendar day that the Contractor shall be in default after the time stipulated in the contract for completing the work.

The said amount is fixed and agreed upon by and between the Contractor and the Owner because of the extreme difficulty in fixing and ascertaining the actual damages the Owner would in such event sustain, and said amount is agreed to be the amount of damages which the Owner would sustain and said amount shall be retained from time to time by the Owner from current periodical estimates.

PART 5 - ARTICLE 9: PAYMENTS AND COMPLETION

5.01 APPLICATIONS FOR PAYMENT

- A. Add the following sub-paragraph:
 - 9.3.1.1 Monthly payments will be based on one hundred (100%) percent of the value of the work done and materials delivered and suitably stored until work under this contract is fifty (50%) completed. If at that time, progress of the work has been satisfactory, there will be no additional retainage, provided the Contractor submits Consent of Surety for each application, authorizing any remaining partial payments to be paid in full. The form of Application for Payment shall be AIA Document G702, Application for Certificate for Payment, supported by AIA Document G702A Continuation Sheet.

PART 6 - ARTICLE 11: INSURANCE AND BONDS

6.01 11.1 CONTRACTOR'S LIABILITY INSURANCE

A. Change as follows:

General Contractor shall take out and maintain insurance of such types and in such amounts as are necessary to cover his responsibilities and liabilities on all projects, and shall require all his subcontractors to carry similar insurance.

- 1. The Owner will accept in lieu of all subcontractors carrying similar insurance an "Owner's and Contractor's Protective Liability Policy" paid for by the Contractor and written in the name of the Owner for the amount specified hereinafter including all the special coverages. Said policy must protect the Owner for all claims for bodily injury and/or property damage arising out of operations for the named insured by said Contractor, or any subcontractor of said Contractor.
- B. No Contractor shall commence work under this contract until he has obtained all insurance required under this section and such insurance has been approved by the Owner, nor shall any Contractor allow any subcontractor to commence work on his subcontract until the same insurance has been obtained by the subcontractor and approved by the Owner. Each and every contractor and subcontractor shall maintain all insurance required under paragraphs (1) and (2) of this section for not less than one year after completion of this contract.
- C. Each Contractor shall file with the Owner and Architect, a Certificate of Insurance. Any certificate submitted and found to be altered or incomplete will be returned as unsatisfactory.
- D. If requested by the Owner, Contractor shall furnish the Owner with true copies of each policy required of him or his subcontractors. Said policies will not be canceled or materially altered, except after fifteen (15) days advance written notice to the Owner and Architect, mailed to the addresses indicated herein.
- E. Insurance under this section, as a minimum, shall include the following coverages:
 - 1. Workman's Compensation and Employer's Liability Insurance: Workman's Compensation and Occupational Disease Insurance of statutory limits as provided by the state in which his contract is performed and Employers' Liability Insurance at a limit of not less than \$100,000.00 for all damages arising from each accident or occupational disease.
 - 2. Comprehensive General Liability Insurance covering:
 - a. Operations- Premises Liability:

Including, but not limited to, Bodily Injury, including death at any time resulting therefrom, to any person or Property Damage resulting from execution of the work provided for in this contract, or due to or arising in any manner from any act of omission or negligence of the Contractor and any Subcontractor, their respective employees or agents.

b. Contractor's Protective Liability:

Including, but not limited to, Bodily Injury, including death at any time, resulting therefrom to any person, or Property Damage arising from acts or omissions of any subcontractor, their employees or agents.

c. Products-- Completed Operation Liability:

Including, but not limited to, Bodily Injury, including death at any time, resulting therefrom to any person, or Property Damage because of goods, products, materials or equipment used or installed under this contract, or because of completed operation, which may become evident within one year after acceptance of the building, including damage to the building or its contents.

d. Contractual Liability:

Each and every policy for liability insurance, carried by each Contractor and Subcontractor, as required by this section shall specifically include Contractual Liability coverage with respect to Section F of this Division.

e. Special Requirements:

The insurance required under Paragraph (2) of this Section shall specifically include the following special hazards:

Property Damage caused by conditions otherwise subject to exclusions "x, c, u," Explosion, Collapse or Underground Damage.

Broad Form Property Damage endorsement, which has reference to property in the "care, custody, or control" of the insured.

"Occurrence" Bodily Injury coverage in lieu of "caused by accident."

"Occurrence" Property Damage coverage in lieu of "caused by accident."

f. Limits of Liability:

The insurance under Paragraph (2) of this Section shall be written in the following limits of liability, as a minimum:

Bodily injury	Property Damage
\$1,000,000 Each Person	\$1,000,000 Each Occurrence
\$3,000,000 Each Occurrence	\$2,000,000 General Aggregate
\$500,000 Aggregate Products	\$1,000,000 Aggregate Protective
	\$1,000,000 Aggregate Contractual

- 3. Comprehensive Automobile Liability covering:
 - a. All owned, hired, or non-owned vehicles including the loading or unloading thereof.
 - b. Special Requirements: The insurance required under paragraph (3) of this section shall specifically include the following special hazards:

"Occurrence" Bodily Injury in lieu of "caused by accident."

"Occurrence" Property Damage in lieu of "caused by accident."

The insurance under Paragraph (3) of this section shall be written in the following limits of liability as a minimum:

Automobile Bodily Injury	Automobile Property Damage
\$1,000,000 Each Person	\$1,000,000 Each Occurrence
\$3,000,000 Each Occurrence	

\$3,000,000 Excess/Umbrella Liability

- F. Hold Harmless Agreement:
 - 1. The Contractor shall indemnify and hold harmless the Owner and the Architect and their agents and employees from and against all claims, damages, losses and expenses including attorney's fees arising out of or resulting from the performance of the work, provided that any such claim, damage, loss or expense (a) is attributable to bodily injury, sickness, disease or death, or to injury to or destruction of tangible property (other than the work itself) including the loss of use resulting therefrom and (b) is caused in whole or part by any negligent act or omission of the Contractor, any subcontractor, anyone directly or indirectly employed by any of them or anyone for whose acts any of them may be liable, regardless of whether or not it is caused in part by a party indemnified hereunder.
 - 2. In any and all claims against the Owner or the Architect or any of their agents or employees by any employee of the Contractor, Subcontractor, anyone directly or indirectly employed by any of them or anyone for whose acts any of them may be liable, the indemnification obligation under this Hold Harmless agreement shall not be limited in any way by any limitation on the amount payable by or for the Contractor or any Subcontractor under workman's compensation acts, disability benefit acts or other employee benefit acts.
 - 3. The obligations of the Contractor under this Hold Harmless Agreement shall not extend to any claim, damage, loss or expense arising out or professional services performed by the Architect, his agents, or employees, including (a) the preparation of maps, plans, opinions, reports, surveys, designs or specifications, and (b) supervisory, inspection or engineering services.

PART 7 - ARTICLE 11.3: PROPERTY INSURANCE (Purchased by the General Contractor)

- 7.01 A. Change the first sentence of paragraph 11.3.1 to read: The contractor shall purchase....
 - B. Change the second sentence of Paragraph 11.3.1 to read:
 - 11.3.1 "This insurance shall include the interests of the Owner, the Contractor, the Subcontractor and Sub-Subcontractors in the work and shall insure against the perils of fire, extended coverage, vandalism, malicious mischief and theft."
 - C. Add the following subparagraph:
 - "11.3.1.1 If by the terms of this insurance any mandatory deductibles are required, or if the Owner should elect to increase the mandatory deductible amounts or purchase this insurance with voluntary deductible amounts, the Owner shall be responsible for payment of the amount of the deductible in the event of a paid claim."
 - 11.3.6 Revise a portion on the first sentence in Subparagraph to read as follows:

"...and (2) the Architect, his consultants, and separation contractors, if any..."

D. Add the following Article to the General Conditions of the Contract for Construction:

PART 8 - ARTICLE 15: EQUAL OPPORTUNITY

- 8.01 15.1 Employment Policies
 - 15.1.1 The Contractor and all Subcontractors shall not discriminate against any employee or applicant for employment because of race, religion, color, sex, national origin or age. The Contractor shall take affirmative action to insure that applicants are employed, and that employees are treated during employment without regard to their race, religion, color, sex, national origin or age. Such action shall include, but not be limited to, the following: employment, upgrading, demotion or transfer; recruitment or recruitment advertising; layoff or termination; rates or pay or other forms of compensation; and selection for training, including apprenticeship. The Contractor agrees to post in conspicuous places, available to employees and applicants for employment, notices setting forth the policies of non-discrimination.
 - 15.12 The Contractor and all Subcontractors shall, in all solicitations or advertisements for employees placed by them or on their behalf, state that all qualified applicants will receive consideration for employment without regard to race, religion, color, sect, national origin or age.

PART 9 - ARTICLE 16: CHARACTER OF WORKERS, METHODS, AND EQUIPMENT

- 16.1 The Contractor shall, at all times, employ sufficient and equipment for prosecuting the work to full completion in the manner and time required by the contract, drawings, and specifications. Suitable number of foremen and supervisors shall be available on the job to insure proper prosecution and coordination of the work. All workers shall have sufficient skill and experience to perform properly the work assigned to them. 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 the work satisfactorily.
- 162 Any person employed by the Contractor or by any subcontractor who, in the opinion of the Owner and Architect, does not perform his work in a proper and skillful manner or is intemperate or disorderly shall, at the written request of the Architect, be removed forthwith by the Contractor or Subcontractor employing such person, and shall not be employed again in any portion of the work.
- 163 Should the Contractor fail to remove such person or persons or fail to furnish suitable and sufficient personnel for the proper prosecution of the work, the Architect may suspend the work by written notice until compliance with such orders.
- 164 After the beginning of work on the site, the Contractor may not remove his Superintendent from the project without the prior written approval of the Owner.

Section 00815 - Supplemental General Conditions Part Two

1) General Contractors and Sub-contractors are hereby notified that they are encouraged, to the greatest extent practicable, to purchase American-made equipment and products with funding provided under this Award.

End of Section

SECTION 01010 - SUMMARY OF WORK

PART 1 - GENERAL

1.01 SUMMARY OF WORK

- A. Work covers construction fit-up of existing PEMB shell in the McCreary County Business Park located on property address: 217 Meadows Grove Rd., Pine Knot, KY 42635.
- B. Existing shell building to remain and be fitted-up with interior work and some limited exterior driveway work, with mechanical/electrical for manufacturing, warehousing and office space
- C. Related requirements specified elsewhere:
 - 1. Submittals- Section 01300
 - 2. Temporary Facilities- Section 01500
 - 3. Project Closeout Section 01700
- C. Contractor's Duties:
 - 1. Except as specifically noted, provide and pay for:
 - a. Labor, materials, tools, and equipment.
 - b. Permits.
 - c. Fees.
 - d. Licenses.
 - e. Taxes.
 - 2. Give required notices.
 - 3. Comply with codes, ordinances, rules, regulations, orders, and other legal requirements of public authorities which bear on performance of work.
 - 4. Promptly submit written notice to Architect of observed variance of Contract Documents from legal requirements.
 - 5. Contractor shall verify all grades, lines, levels, and dimensions indicated on the drawings and shall report any inconsistencies before commencing work.
 - 6. Each Sub Contractor shall be responsible for the layout for their specific phase of work.

1.02 CONTRACT (OWNER AND GENERAL CONTRACTOR)

A. Construction work shall be under a single lump sum contract, which shall include all general construction, steel, concrete, mechanical, electrical, plumbing and site work, etc.

1.03 CONTRACTORS' USE OF PREMISES

A. Confine operations at site to areas permitted by:

General Contractor can store material in the existing building and use existing utilities.

- 1. Law.
- 2. Ordinances.
- 3. Permits.
- 4. Contract Documents.
- 5. Owner.
- B. Do not unreasonably encumber site with materials or equipment.
- C. Do not load structure with weight that will endanger structure.
- D. Assume full responsibility for protection and safekeeping of products stored on site.
- E. Move any stored products which interfere with operations of the Owner.

SECTION 01027 - APPLICATIONS FOR PAYMENT REQUIREMENTS OF CONTRACTOR

PART 1 - GENERAL

1.01 SECTION INCLUDES:

A. Procedures of Contractor for preparation and submittal of applications for payment.

1.02 RELATED SECTIONS

- A. Document 00500 Agreement: Contract Sum amounts of progress payments and retainages.
- B. Section 00800 Supplementary Conditions: Progress payments and final payment.
- C. Section 01028 Modification Requirements: Procedures for changes to the Work.
- D. Section 01300 Submittals: Submittal procedures.
- E. Section 01700 Contract Closeout Final Payment

1.03 FORMAT

- A. For each item, provide a column for listing each of the following:
 - 1. Item Number.
 - 2. Description of Work.
 - 3. Scheduled Values.
 - 4. Previous Applications.
 - 5. Work in Place and Stored Materials under this Application.
 - 6. Authorized Change Orders.
 - 7. Total Completed and Stored to Date of Application.
 - 8. Percentage of Completion.
 - 9. Balance to Finish.
 - 10. Retainage.

1.04 PREPARATION OF APPLICATIONS

- A. Present required information in typewritten form on specified AIA Documents.
- B. Execute certification by signature of authorized officer.
- C. Use data from approved Schedule of Values. Provide dollar value in each column for each line item for portion of work performed and for stored Products.

- D. List each authorized Change Order as an extension on <u>AIA G703 Continuation Sheet</u>, listing Change Order number and dollar amount as for an original item of Work.
- E. Prepare Application for Final Payment as specified in Section 01700.
- F. Submit partial release of liens waiver for all work completed to date with each payment application.
- G. Submit up-to-date (revised) construction schedule.

1.05 SUBMITTAL PROCEDURES

- A. Submit three copies of each Application for Payment.
- B. Submit an updated construction schedule with each Application for Payment.
- C. Payment Period: Submit at intervals stipulated in the Agreement.
- D. Submit with transmittal letter as specified for Submittals in Section 01300.

1.06 DETAILED COST BREAKDOWN

A. Upon award of contract, Contractor will have seven working days to generate a finalized cost breakdown of the project.

1.07 SUBSTANTIATING DATA

- A. When Architect/Engineer requires substantiating information, Contractor shall submit data justifying dollar amounts in question.
- B. Provide one copy of data with cover letter for each copy of submittal. Show application number and date, and line item by number and description.

PART 2 - PRODUCTS

Not Applicable.

PART 3 - EXECUTION

Not Applicable.

SECTION 01028 - MODIFICATION REQUIREMENTS OF CONTRACTOR

PART 1 - GENERAL

1.01 SECTION INCLUDES:

- A. Submittals.
- B. Documentation of change in Contract Sum and Contract Time.
- C. Change procedures.
- D. Construction Change Directive.
- E. Stipulated Sum change order.
- F. Execution of change orders.
- G. Correlation of Contractor submittals.

1.02 SUBMITTALS

- A. Submit name of the individual authorized to receive change documents, and be responsible for informing others in Contractor's employ or Subcontractors of changes to the Work.
- B. Change Order Forms: AIA G701 Change Order.

1.03 DOCUMENTATION OF CHANGE IN CONTRACT SUM AND CONTRACT TIME

- A. Maintain detailed records of work performed. Provide full information required for evaluation of proposed changes, and to substantiate costs of changes in the Work.
- B. Document each quotation for a change in cost or time with sufficient data to allow evaluation of the quotation.
- C. Provide additional data to support computations:
 - 1. Quantities of products, labor, and equipment.
 - 2. Taxes, insurance, and bonds.
 - 3. Overhead and profit.
 - 4. Justification for any change in Contract Time.
 - 5. Credit for deletions from Contract, similarly documented.
- D. Support each claim for additional costs, and for work performed, with additional information:
 - 1. Origin and date of claim.
 - 2. Dates and times work was performed, and by whom.
 - 3. Time records and wage rates paid.
 - 4. Invoices and receipts for products, equipment, and subcontracts, similarly documented.

1.04 CHANGE PROCEDURES

- A. The Architect/Engineer will advise of minor changes in the Work not involving an adjustment to Contract Sum/Price or Contract Time as authorized by <u>AIA A201</u>, 2007 Edition, Paragraph 7.4 by issuing supplemental instructions on <u>AIA Form G710</u>.
- B. The Architect/Engineer may issue a Proposal Request which includes a detailed description of a proposed change with supplementary or revised Drawings and specifications, a change in Contract Time for executing the change. Contractor will prepare and submit an estimate within seven (7) days.

1.05 CONSTRUCTION CHANGE DIRECTIVE

- A. Architect/Engineer may issue a document, signed by the Owner, instructing the Contractor to proceed with a change in the Work, for subsequent inclusion in a Change Order.
- B. The document will describe changes in the Work, and will designate method of determining any change in Contract Sum or Contract Time.
- C. Contractor shall include in his costs any and all costs associated with contract documents modification required by the Architect/Engineer as a part of modifications.
- D. Promptly execute the change in Work.

1.06 STIPULATED SUM CHANGE ORDER

A. Based on Proposal Request and Contractor's fixed price quotation.

1.07 CHANGE ORDER

- A. Submit itemized account and supporting data after completion of change, within time limits indicated in the Conditions of the Contract.
- B. Architect/Engineer will determine the change allowable in Contract Sum and Contract Time as provided in the Contract Documents pending Owner approval.
- C. Maintain detailed records of work performed.
- D. Provide full information required for evaluation of proposed changes, and to substantiate costs for changes in the Work.

1.08 EXECUTION OF CHANGE ORDERS

A. Execution of Change Orders: Architect/Engineer will issue Change Orders for signatures of parties as provided in the Conditions of the Contract.
1.09 CORRELATION OF CONTRACTOR SUBMITTALS

- A. Promptly revise Schedule of Values and Application for Payment forms to record each authorized Change Order as a separate line item and adjust the Contract Sum.
- B. Promptly revise progress schedules to reflect any change in Contract Time, revise subschedules to adjust times for other items of work affected by the change, and resubmit.
- C. Promptly enter changes in Project Record Documents.

PART 2 - PRODUCTS

Not Used.

PART 3 - EXECUTION

Not Used.

SECTION 01041 - PROJECT COORDINATION

PART 1 - GENERAL

1.01 SECTION INCLUDES

- A. Project coordination.
- B. Construction mobilization.
- C. Schedules.
- D. Submittals.
- E. Coordination drawings.
- F. Closeout procedures.

1.02 RELATED SECTIONS

- A. Section 00800 Supplementary Conditions
- B. Section 01011 Summary of Project: Work sequence.
- C. Section 01700 Contract Closeout: Contract Closeout Procedures.

1.03 CONSTRUCTION MOBILIZATION

- A. Comply with procedures for intra-project communications; submittals, reports and records, schedules, coordination drawings, and recommendations; and resolution of ambiguities and conflicts.
- B. Comply with instructions for use of temporary utilities and construction facilities.
- C. Coordinate field engineering and layout work.

1.04 SCHEDULES

- A. Submit preliminary progress schedule in accordance with Section 01310.
- B. After review, revise and resubmit schedule to comply with revised Project schedule. Submit revised or up-to-date schedule with each application for payment.
- C. During progress of work revise and resubmit as directed.

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1.05 SUBMITTALS

- A. Provide submittals for review and transmittal to Architect/Engineer.
- B. Submit applications for payment on <u>AIA G702</u> forms for review, and for transmittal to Architect/Engineer.
- C. Submit requests for interpretation of Contract Documents, and obtain instructions through the Architect/Engineer.
- D. Process requests for substitutions, and change orders.
- E. Deliver closeout submittals for review and preliminary inspection reports, for transmittal to Architect/Engineer.

1.06 COORDINATION DRAWINGS

- A. Provide information required by Architect/Engineer for preparation of coordination drawings.
- B. Review drawings prior to submission to Architect/Engineer.

1.07 CLOSEOUT PROCEDURES

- A. Notify Architect/Engineer when Work is considered ready for Substantial Completion.
- B. Comply with Architect/Engineer's instructions to correct items of work listed in executed Certificates of Substantial Completion and for access to Owner occupied areas.
- C. Notify Architect/Engineer when Work is considered finally complete.
- D. Comply with instructions for completion of items of Work determined by Architect/Engineer's final inspection.

PART 2 - PRODUCTS

Not Used.

PART 3 - EXECUTION

Not Used.

SECTION 01045 - CUTTING AND PATCHING REQUIREMENTS OF CONTRACTOR

PART 1 - GENERAL

1.01 SECTION INCLUDES

- A. Requirements and limitations for cutting and patching of Work, including:
 - 1. Cutting, fitting, or patching that may be required to complete the work or make its several parts fit together properly.
 - 2. Uncovering work to provide for installation of ill-timed work.
 - 3. Removing and replacing defective work.
 - 4. Removing and replacing work not conforming to requirements of the Contract Documents.
 - 5. General Contractor shall be responsible for cutting and patching of construction as required to facilitate work, including work by his mechanical and electrical subcontractors. He shall assign proper trades normally associated with the materials being cut and patched to perform work.

1.02 RELATED SECTIONS

- A. Section 01010 Summary of Work.
- B. Section 01300 Submittals.
- C. Section 01620 Product Delivery, Storage and Handling.
- D. Individual Product Specification Sections:
 - 1. Cutting and patching incidental to work of the section.
 - 2. Advance notification to other sections of openings required in work of those sections.

1.03 SUBMITTALS

- A. Submit written request in advance of cutting or alteration which affects:
 - 1. Structural integrity of any element of Project.
 - 2. Integrity of weather exposed or moisture resistant element.
 - 3. Efficiency, maintenance, or safety of any operational element.
 - 4. Visual qualities of sight exposed elements.
 - 5. Work of Owner or separate contractor.

- B. Include in request:
 - 1. Identification of Project.
 - 2. Location and description of affected Work.
 - 3. Necessity for cutting or alteration.
 - 4. Description of proposed Work and Products to be us.
 - 5. Alternatives to cutting and patching.
 - 6. Effect on work of Owner or separate contractor.
 - 7. Written permission of affected separate contractor.
 - 8. Date and time work will be executed.

PART 2 - PRODUCTS

2.01 MATERIALS

- A. Primary Products: Those required for original installation.
- B. Product Substitution: For any proposed change in materials, submit request for substitution.

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Examine existing conditions prior to commencing Work, including elements subject to damage or movement during cutting and patching.
- B. After uncovering existing Work, assess conditions affecting performance of work.
- C. Beginning of cutting or patching means acceptance of existing conditions.

3.02 PREPARATION

- A. Provide temporary supports to ensure structural integrity of the Work. Provide devices and methods to protect other portions of Project from damage.
- B. Provide protection from elements for areas which may be exposed by uncovering work.
- C. Maintain excavations free of water.

3.03 CUTTING

- A. Execute cutting and fitting including excavation and fill to complete the Work.
- B. Uncover work to install improperly sequenced work.
- C. Remove and replace defective or non-conforming work.
- D. Provide openings in the Work for penetration of mechanical and electrical work.
- E. Employ skilled and experienced installer to perform cutting for weather exposed and moisture resistant elements, and sight exposed surfaces.
- F. Cut rigid materials using masonry saw or core drill. Pneumatic tools not allowed without prior approval.

3.04 PATCHING

- A. Execute patching to complement adjacent Work.
- B. Fit Products together to integrate with other Work.
- C. Execute work by methods to avoid damage to other Work, and which will provide appropriate surfaces to receive patching and finishing.
- D. Employ original installer to perform patching for weather exposed and moisture resistant elements, and sight-exposed surfaces.
- E. Restore work with new products in accordance with requirements of Contract Documents.
- F. Fit work air tight to pipes, sleeves, ducts, conduit, and other penetrations through surfaces.
- G. At penetrations of fire rated walls, partitions, ceiling, or floor construction, completely seal voids with fire resistant material to full thickness of the penetrated element.
- H. Refinish surfaces to match adjacent finish. For continuous surfaces, refinish to nearest intersection or natural break. For an assembly, refinish entire unit. When possible, do not cut-and-patch work which is exposed in occupied spaces of building, in a manner resulting in reductions of visual qualities or resulting substantial evidence of cut-and-patch work, both as judged solely by Architect. Remove and replace work judged by Architect to be cut-and-patched in a visually unsatisfactory or otherwise objectionable manner.

SECTION 01300 - SUBMITTALS

PART 1 - GENERAL

1.01 SECTION INCLUDES

- A. Submittal procedures.
- B. Shop Drawings.
- C. Test reports.
- D. Certificates.
- E. Erection drawings.

1.02 REFERENCES

A. AGC (Associated General Contractors of America) publication "The Use of CPM in Construction - A Manual for General Contractors and the Construction Industry".

1.03 SUBMITTAL PROCEDURES FOR SHOP DRAWINGS

- A. All shop drawings must be reviewed be the General Contractor before submitting them to the Architect.
- B. Transmit each submittal with accepted form, containing the following:
 - 1. Date
 - 2. Project title
 - 3. Contractor's name and address
 - 4. Notification of any deviations from the contract documents.
 - 5. Identify project as "<u>McCreary Co. Spec Building Fit-up</u>"
 - 6. Other pertinent data as required.
- C. Identify Project, Contractor, Subcontractor, Manufacturer or supplier; pertinent drawing and detail number, and specification section number, as appropriate.
 - 1. Provide identification of product or material size, type, finish and color as appropriate.
 - 2. Field dimensions, clearly identified as such.
 - 3. All working and erection dimensions, views, as required to indicate fully all construction and fabrication methods, profiles and materials.
- D. On all shop drawings apply Contractor's stamp, signed or initialed certifying that review, approval, verification of Products required, field dimensions, adjacent construction Work, and coordination of information is in accordance with the requirements of the Work and Contract Documents.

1.04 CERTIFICATES

- A. When specified in individual specifications sections, submit certification by the manufacturer, installation/application/subcontractor, or the Contractor to Architect/ Engineer, in quantities specified for Product Data.
- B. Indicate material or Product conforms to or exceeds specified requirements. Submit supporting reference data, affidavits, and certifications as appropriate.
- C. Certificates may be recent or previous test results on material or Product, but must be acceptable to Architect/Engineer.

PART 2 - PRODUCTS

Not used.

PART 3 - EXECUTION

Not used.

SECTION 01310 - CONSTRUCTION PROGRESS SCHEDULES

PART 1 - GENERAL

1.01 SECTION INCLUDES

- A. Format.
- B. Content.
- C. Revisions to schedules.
- D. Submittals.

1.02 RELATED SECTIONS

- A. Section 01011 Summary of Work.
- B. Section 01027 Applications for Payment: Application for payment.
- C. Section 01300 Submittals: Shop drawings.

1.03 REFERENCES

A. AGC (Associated General Contractors of America) publication "The Use of CPM in Construction - A Manual for General Contractors and the Construction Industry".

1.04 FORMAT

- A. Prepare schedules starting with Notice to Proceed date through substantial completion, as a horizontal bar chart or Gantt chart with separate bar for each major portion of Work or operation, identifying first work day of each week.
- B. Sequence of Listings: The chronological order of the start of each item of Work.
- C. Scale and Spacing: To provide space for notations and revisions.
- D. Sheet Size: Maximum 30" x 42" OR multiples of 8¹/₂" x 11".

1.05 CONTENT

- A. Show complete sequence of construction by activity, with dates for beginning and completion of each element of construction.
- B. Identify each item by specification section number.
- C. Identify work of separate stages and other logically grouped activities.
- D. Provide sub-schedules for each stage of Work.
- E. Provide sub-schedules to define critical portions of the entire schedule.
- F. Include conferences and progress meetings in schedule.
- G. Show accumulated percentage of completion of each item, and total percentage of Work completed, to coincide with schedule of values in each application for payment.

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- H. Provide separate schedule of submittal dates for shop drawings, product data, and samples, including Owner furnished products and dates reviewed submittals will be required from Architect/Engineer. Indicate decision dates for selection of finishes.
- I. Include scheduling for fabrication of structural steel.
- J. Include scheduling of erection sequence of building structural steel, precast walls and delivery to site.
- K. Include scheduling of erection sequence of building precast walls and delivery to site.

1.06 REVISIONS TO SCHEDULES

- A. Indicate progress of each activity to date of submittal, and projected completion date of each activity.
- B. Identify activities modified since previous submittal, major changes in scope, and other identifiable changes.
- C. Provide narrative report to define problem areas, anticipated delays, and impact on Schedule. Report corrective action taken, or proposed, and its effect including the effect of changes on schedules of separate contractors.

1.07 SUBMITTALS

- A Submit initial schedules within 15 days after date of Owner-Contractor Agreement. After review, resubmit required revised data within seven days.
- B. Submit revised Progress Schedules with each Application for Payment.
- C. Submit the number of opaque reproductions which Contractor requires, plus two copies which will be retained by Architect/Engineer.

1.08 DISTRIBUTION

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

PART 2 - PRODUCTS

Not Used.

PART 3 - EXECUTION

Not Used.

END OF SECTION

01310 - 2

SECTION 01400 - QUALITY CONTROL

PART 1 - GENERAL

1.01 SECTION INCLUDES

- A. Quality assurance control of installation.
- B. Tolerances
- C. Mock-up.
- D. Manufacturers' field services.

1.02 RELATED SECTIONS

- A. Section 01300 Submittals: Submission of manufacturers' instructions and certificates.
- B. Section 01410 Testing Services.
- C. Section 01620 Product Delivery, Storage and Handling.
- D. Section 01650 Starting of Systems

1.03 QUALITY ASSURANCE - CONTROL OF INSTALLATION

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

1.04 TOLERANCES

- A. Monitor fabrication and installation tolerance control of Products to produce acceptable Work. Do not permit tolerances to accumulate.
- B. Comply with manufacturers' tolerances. Should manufacturers' tolerances conflict with Contract Documents, request clarification from Architect/Engineer before proceeding.
- C. Adjust Products to appropriate dimensions; position before securing Products in place.

1.05 MOCK-UP

- A. Tests will be performed under provisions identified in this section and identified in the respective Product specification sections.
- B. Assemble and erect specified items with specified attachment and anchorage devices, flashings, seals, and finishes.
- C. Accepted mock-ups shall be a comparison standard for the remaining Work.
- D. Where mock-up has been accepted by Architect/Engineer and is specified in product specification sections to be removed; remove mock-up and clear area when directed to do so.

1.06 MANUFACTURERS' FIELD SERVICES

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

PART 2 - PRODUCTS

Not Used.

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Verify that existing site conditions and substrate surfaces are acceptable for subsequent Work. Beginning new Work means acceptance of existing conditions.
- B. Examine and verify specific conditions described in individual specification sections.
- C. Verify that utility services are available, of the correct characteristics, and in the correct locations.

3.02 PREPARATION

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

END OF SECTION

01400 - 2

SECTION 01500 - CONSTRUCTION FACILITIES AND TEMPORARY CONTROLS REQUIREMENTS OF CONTRACTOR

PART 1 - GENERAL

1.01 SECTION INCLUDES

- A. Temporary Controls: Barriers, enclosures and fencing, protection of the Work, and water control.
- B. Construction Facilities: Access roads, parking and progress cleaning.

1.02 RELATED SECTIONS

- A. Section 01510 Temporary Utilities.
- B. Section 01540 Security.
- C. Section 01550 Access Roads and Parking Areas.
- D. Section 01580 Project Identification and Signs.
- E. Section 01700 Project Closeout: Final cleaning.

1.03 BARRIERS

- A. Provide barriers to prevent unauthorized entry to construction areas and to protect existing facilities and adjacent properties from damage from construction operations.
- B. Provide protection for plants designated to remain. Replace damaged plants.
- C. Protect non-owned vehicular traffic, stored materials, site, and structures from damage.

1.04 WATER CONTROL

- A. Protect site from puddling or running water. Provide water barriers as required to protect site from soil erosion.
- 1.05 PROTECTION OF INSTALLED WORK
 - A. Protect installed Work and provide special protection where specified in individual specification sections.
 - B. Provide temporary and removable protection for installed Products. Control activity in immediate work area to prevent damage.
 - C. Provide protective coverings at walls, projections, jambs, sills, and soffits of openings.
 - D. Protect finished floors, stairs, and other surfaces from traffic, dirt, wear, damage, or movement of heavy objects, by protecting with durable sheet materials.
 - E. Prohibit traffic or storage upon waterproofed or roofed surfaces. If traffic or activity is

necessary, obtain recommendations for protection from waterproofing or roofing material manufacturer.

F. Prohibit traffic from landscaped areas.

1.06 PROGRESS CLEANING AND WASTE REMOVAL

- A. Maintain areas free of waste materials, debris, and rubbish. Maintain site in a clean and orderly condition.
- B. Remove debris and rubbish from pipe chases, plenums, attics, crawl spaces, and other closed or remote spaces, prior to enclosing the space.
- C. Broom and vacuum clean interior areas prior to start of surface finishing, and continue cleaning to eliminate dust.
- D. Collect and remove waste materials, debris, and rubbish from site periodically and dispose off-site.
- E. Open free-fall chutes are not permitted. Terminate closed chutes into appropriate containers with lids.

PART 2 - PRODUCTS

Not Used.

PART 3 - EXECUTION

Not Used.

SECTION 01580 - PROJECT IDENTIFICATION AND SIGNS REQUIREMENTS OF CONTRACTOR

PART 1 - GENERAL

There will be one (1) sign for this project.

- 1.01 SECTION INCLUDES
 - A. Project identification sign.

1.02 RELATED SECTIONS

- A. Section 01010 Summary of Work.
- 1.03 QUALITY ASSURANCE
 - A. Design sign and structure to withstand 60 miles/hr wind velocity.
 - B. Sign Painter: Experienced as a professional sign painter for minimum three years.
 - C. Finishes, Painting: Adequate to withstand weathering, fading, and chipping for duration of construction.

1.04 SUBMITTALS

- A. Section 01300 Submittals: Shop drawings.
- B. Show content, layout, lettering, color, foundation, structure, sizes, and grades of members.

PART 2 - PRODUCTS

- 2.01 SIGN MATERIALS
 - A. Structure and Framing: New wood, structurally adequate.
 - B. Sign surfaces: Exterior grade plywood with medium density overlay, minimum 3/4 inch thick, standard large sizes to minimize joints.
 - C. Rough Hardware: Galvanized.
 - D. Paint and Primers: Exterior quality, two coats; sign background of color as selected.
 - E. Lettering: Exterior quality paint, contrasting colors as selected.

2.02 PROJECT IDENTIFICATION SIGN

A. One painted sign of construction, design, and content shown on Drawings, location designated.

01580 - 1

- B. Content:
 - 1. Project title, logo and name of Owner as indicated on Contract Documents.
 - 2. Names and titles of authorities.
 - 3. Names and titles of Architect/Engineer and Consultants.
 - 4. Name of Prime Contractor and major Subcontractors.
- C. Graphic Design, Colors, Style of Lettering: Designated by Architect/Engineer and approved by Owner.

2.03 PROJECT INFORMATIONAL SIGNS

- A. Painted informational signs of same colors and lettering as Project Identification sign, or standard products; size lettering to provide legibility at 100-foot distance.
- B. Provide at each field office, and directional signs to direct traffic into and within site. Relocate as Work progress requires.

PART 3 - EXECUTION

3.01 INSTALLATION

- A. Install project identification sign within 30 days after date fixed by Owner-Contractor Agreement.
- B. Erect at designated location.
- C. Erect supports and framing on secure foundation, rigidly braced and framed to resist wind loadings.
- D. Install sign surface plumb and level, with butt joints. Anchor securely.
- E. Paint exposed surfaces of sign, supports, and framing.

3.02 MAINTENANCE

A. Maintain signs and supports clean, repair deterioration and damage.

3.03 REMOVAL

A. Remove signs, framing, supports, and foundations at completion of Project and restore the area.

McCreary County Spec Building Fit-up Pine Knot, Kentucky

Owner: McCreary County Industrial Development Authority Whitley City, KY 42653

Engineer: MSE of Kentucky, Inc.

Lexington, KY 40503

859-223-5694

Contractor:



SECTION 01620 - PRODUCT DELIVERY, STORAGE & PROTECTION

PART 1 - GENERAL

1.01 APPLICABILITY

A. This Section applies to all products furnished under this Agreement. Shipments of equipment or materials to be used by the Contractor or its subcontractors shall be delivered to the site only during regular working hours. All shipping papers and shipments shall be addressed and consigned to the Contractor giving the name of the Project with address. Under no circumstances will Owner accept shipments directed to it or the Architect/Engineer unless otherwise specified.

1.02 DELIVERY

- A. Products shall not be delivered to the Owner or the Architect/Engineer.
- B Products shall not be delivered to the project site until related shop drawings have been reviewed by the Architect/Engineer.
- C. Products shall not be delivered to the project site until appropriate storage facilities are in place (on-site storage space is very limited).
- D. Products shall be delivered to the site in manufacturer's original, unopened, labeled containers.
- E. The Contractor shall not drop, roll or skid products off delivery vehicles. Hand carry or use suitable materials-handling equipment.

1.03 STORAGE AND PROTECTION

- A. General:
 - 1. The Contractor shall store and protect products in accordance with the manufacturer's recommendations and the requirements specified herein. No on-site existing storage facilities are available for use by the Contractor. All on-site facilities for storage shall be furnished by the Contractor.
 - 2. The Contractor shall not block or restrict the use of public right-of way, access roads or private property with stored materials.
 - 3. The Contractor shall not store products where they will interfere with operations of the Owner.
 - 4. The Contractor shall protect all products from damage or deterioration by weather.

- 5. The Contractor shall not store any products directly on the ground.
- 6. The Contractor shall not store any products in drainage ditches or areas where water may stand.
- 7. The Contractor shall label containers to identify materials inside using the terminology found in these Specifications.
- B. Uncovered Storage:
 - 1. The following types of materials may be stored out of doors without cover:
 - a. Masonry units
 - b. Reinforcing steel
 - c. Piping
 - d. Precast concrete items
 - e. Castings
 - 2. The above-mentioned materials shall be stored on wood blocking.
- C. Fully Protected Storage:
 - 1. The Contractor shall store all products not named above in buildings or trailers which have a concrete or wooden floor, a roof; and fully enclosed walls on all sides.
 - 2. The Contractor shall provide heated storage space for materials which would be damaged by freezing.
 - 3. The Contractor shall protect mechanical and electrical equipment from being contaminated by dust and dirt.
 - 4. The Contractor shall maintain temperature and humidity at levels recommended by manufacturer(s) for electrical and electronic equipment.

SECTION 01650 - STARTING OF SYSTEMS

PART 1 - GENERAL

1.01 SECTION INCLUDES

- A. Starting systems.
- B. Demonstration and instructions.
- C. Testing, adjusting, and balancing.

1.02 RELATED SECTIONS

- A. Section 01400 Quality Control: Manufacturers field reports.
- B. Section 01700 Contract Closeout: System operation and maintenance data and extra materials.

1.03 STARTING SYSTEMS

- A. Coordinate schedule for start-up of various equipment and systems.
- B. Notify Owner seven days prior to start-up of each item.
- C. Verify that each piece of equipment or system has been checked for proper lubrication, drive rotation, belt tension, control sequence, and for conditions which may cause damage.
- D. Verify tests, meter readings, and specified electrical characteristics agree with those required by the equipment or system manufacturer.
- E. Verify that wiring and support components for equipment are complete and tested.
- F. Execute start-up under supervision of applicable manufacturer's representative or Contractors' personnel in accordance with manufacturers' instructions.
- G. When specified in individual specification Sections, require manufacturer to provide authorized representative to be present at site to inspect, check, and approve equipment or system installation prior to start-up, and to supervise placing equipment or system in operation.

1.04 DEMONSTRATION AND INSTRUCTIONS

- A. Demonstrate operation and maintenance of Products to Owner's personnel prior to date of Substantial Completion.
- B. For equipment or systems requiring seasonal operation, perform demonstration for other season within six months.
 - 1. Warranty period to begin at start-up of season.
- C. Utilize operation and maintenance manuals as basis for instruction. Review contents of manual with Owners' personnel in detail to explain all aspects of operation and maintenance.
- D. Demonstrate start-up, operation, control, adjustment, trouble-shooting, servicing, maintenance, and shutdown of each item of equipment at scheduled time at designated location.
- E. Prepare and insert additional data in operations and maintenance manuals when need for additional data becomes apparent during instruction.
- F. The amount of time required for instruction on each item of equipment and system is that specified in individual sections.

PART 2 - PRODUCTS

Not Used.

PART 3 - EXECUTION

Not Used.

SECTION 01700 - PROJECT CLOSEOUT REQUIREMENTS OF CONTRACTOR

PART 1 - GENERAL

1.01 SECTION INCLUDES

- A. Closeout procedures.
- B. Final cleaning.
- C. Adjusting.
- D. Project record documents.
- E. Operation and maintenance data.
- F. Spare parts and maintenance products.
- G. Warranties and bonds.
- 1.02 RELATED SECTIONS
 - A. Section 01650 Starting of Systems: System start-up, testing, adjusting, and balancing.
- 1.03 CLOSEOUT PROCEDURES
 - A. Submit written certification that Contract Documents have been reviewed, Work has been inspected, and that Work is complete in accordance with Contract Documents and ready for Architect/Engineer's review.
 - B. Provide submittals to Architect/Engineer that are required by governing or other authorities.
 - C. Submit final Application for Payment identifying total adjusted Contract Sum, previous payments, and sum remaining due.
 - D. Deliver all close-out documents to the Architect within forty-five (45) days of the date of Substantial Completion. Indemnify the Architect for failure to perform this requirement including legal fees incurred by the Architect in enforcing this requirement. Failure to deliver all required close-out documents to the Architect within forty-five (45) days from sign-off of <u>AIA Document G704</u>, "Certificate of Substantial Completion," shall invoke costs of the Architect's services to be borne by the Contractor.
 - E. Submit Certificate of Substantial Completion: <u>AIA Document G704</u>, 2017 Edition.
 - F. Submit Contractor's Affidavit of Payment of Debts and Claims: <u>AIA Document G706</u>, 1994 Edition.

- G. Submit Contractor's Affidavit of Release of Liens: <u>AIA Document G706A</u>, 1994 Edition.
- H. Submit certification prior to submission of final application for payment attesting those certain products meet <u>required manufacturer's approval.</u>

1.04 FINAL CLEANING

- A. Execute final cleaning prior to final project assessment. Use experienced workmen or professional cleaners for final cleaning.
- B. Clean interior and exterior glass, surfaces exposed to view; remove temporary labels, stains and foreign substances, polish transparent and glossy surfaces, vacuum carpeted and soft surfaces.
- C. Clean equipment and fixtures to a sanitary condition with cleaning materials appropriate to the surface and material being cleaned.
- D. Replace filters of operating equipment.
- E. Clean debris from roofs, gutters, downspouts, and drainage systems.
- F. Clean site; sweep paved areas, rake clean landscaped surfaces.
- G. Remove waste and surplus materials, rubbish, and construction facilities from the site weekly (or more often as required by accumulation). Remove waste materials, rubbish and debris from the site and legally dispose of at public or private dumping areas off-site at least once a week. Site to be approved by Owner.
- H. Each subcontractor has the responsibility for protecting equipment and finishes at the job site from damages resulting from work under his control, for all cleaning required as a result of his failure to protect equipment and finishes, and for removal of protective covers.
- I. Safety Standards: Maintain project in accordance with the OSHA safety standards, as stipulated under the Occupational Safety and Health Act of 1970 and printed May 29, 1971 in the Federal Register.
- J. Fire Protection: Store volatile waste in covered metal containers and remove from premises daily.
- K. Pollution Control: Conduct cleanup and disposal operations to comply with local ordinances and anti-pollution laws.
 - 1. Disposal of volatile fluid wastes (such as mineral spirits, oil, or paint thinner) in storm or sanitary sewer systems or into streams or waterways is not permitted.

- L. Vacuum clean interior building areas when ready to receive finish painting and continue vacuum cleaning on an as-needed basis until building is ready for acceptance or occupancy.
- M. Repair, patch and touch-up marred surfaces to match adjacent finishes. Coordinate with requirements specified under the various sections of these specifications.
- N. Schedule cleaning operations so that dust and other contaminants resulting from cleaning process will not fall on wet, newly-painted surfaces.

1.05 ADJUSTING

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

1.06 PROJECT RECORD DOCUMENTS

- A. Maintain on site one set of the following record documents in clean, dry, legible condition; record actual revisions to the Work:
 - 1. Drawings
 - 2. Specifications
 - 3. Addenda
 - 4. Change Orders and other modifications to the Contract.
 - 5. Reviewed Shop Drawings, Product Data, and Samples.
 - 6. Manufacturer's instruction for assembly, installation, adjusting, maintenance and operation.
- B. Ensure entries are complete and accurate, enabling future reference by Owner.
- C. Store record documents separate from documents used for construction.
- D. Record information concurrent with construction progress. Label each document "Project Record."
- E. Specifications: Legibly mark and record at each Product section description of actual Products installed, including the following:
 - 1. Manufacturer's name and product model and number.
 - 2. Product substitutions or alternates utilized.
 - 3. Changes made by Addenda and modifications.
- F. Record Drawings: Legibly mark each item to record actual construction including:
 - 1. Measured depths of foundations in relation to finish first floor datum.
 - 2. Measured horizontal and vertical locations of underground utilities and appurtenances, referenced to permanent surface improvements.
 - 3. Measured locations of internal utilities and appurtenances concealed in construction, referenced to visible and accessible features of the Work.
 - 4. Field changes of dimension and detail.

- 5. Details not on original Contract drawings.
- 6. Review applied changes to C.A.D. drawings.
- G. Submit documents to Architect/Engineer prior to claim for final Application for Payment.
 - 1. The Contractor shall submit to the Architect one set of "Record" drawings which accurately reflect the actual installation of any and all materials, piping, conduit, etc., which were not installed exactly in accordance with the contract drawings.
 - 2. Contractor shall submit to the Architect two (2) (corrected) final record copies of shop drawings marked "for job use" which reflect all changes required in previous submittals including these marked "Approved as Noted," or similarly revised by the Engineer.

1.07 OPERATION AND MAINTENANCE DATA

- A. Submit data bound in 8½ x 11-inch (A4) text pages, three D side ring binders with durable plastic covers.
- B. Prepare binder cover with printed title "OPERATION AND MAINTENANCE INSTRUCTIONS."
- C. Internally subdivide the binder contents with permanent page dividers, logically organized as described below; with tab titling clearly printed under reinforced laminated plastic tabs.
- D. Contents: Prepare a Table of Contents for each volume, with each Product or system description identified, typed on white paper, in three parts as follows:
 - 1. Part 1: Directory, listing names, addresses, and telephone numbers of Architect/ Engineer, Contractor, Subcontractors, and major equipment suppliers.
 - 2. Part 2: Operation and maintenance instructions, arranged by system and subdivided by specification section. For each category, identify names, addresses, and telephone numbers of Subcontractors and suppliers. Identify the following:
 - a. Significant design criteria.
 - b. List of equipment.
 - c. Parts list for each component.
 - d. Operating instructions.
 - e. Maintenance instructions for equipment and systems.
 - f. Maintenance instructions for special finishes, including recommended cleaning methods and materials, and special precautions identifying detrimental agents.
 - 3. Part 3: Project documents and certificates, including the following:
 - a. Shop drawings and product data.
 - b. Air and water balance reports.
 - c. Certificates.
 - d. Originals of warranties.

- E. Submit 1 draft copy of completed volumes 15 days prior to final inspection. This copy will be reviewed and returned after final inspection, with Architect/Engineer comments. Revise content of all document sets as required prior to final submission.
- F. Submit three (3) sets of revised final volumes to Architect/Engineer within thirty (30) days of Architect/Engineer review.

1.08 SPARE PARTS AND MAINTENANCE PRODUCTS

- A. Provide spare parts, maintenance, and extra Products in quantities specified in individual specification sections.
- B. Deliver to Project site and place in location as directed by Owner; obtain receipt prior to final payment.

1.09 WARRANTIES AND BONDS

- A. Provide notarized copies.
- B. Execute and assemble transferable warranty documents from Subcontractors, suppliers, and manufacturers.
- C. Provide Table of Contents and assemble in three D side ring binder with durable plastic cover.
- D. Submit one (1) original and two (2) copies prior to final Application for Payment. All such documents shall indicate the name and location of the project and the name of the purchaser.
- E. For items of Work delayed beyond date of Substantial Completion, provide updated submittal within 10 days after acceptance, listing date of acceptance as start of warranty period.

PART 2 - PRODUCTS

Not Used.

PART 3 - EXECUTION

Not Used.

SECTION 02100 - EROSION CONTROL

PART I - GENERAL

1.1 WORK INCLUDED

Submit KPDES Notice of Intent (NOI) and all follow-up information. Take responsibility for locating, furnishing, installing, and maintaining temporary sediment and erosion control best management practices for earth disturbing activity areas and developing a Best Management Practices (BMP) Plan using good engineering practices as required by the Kentucky Pollutant Discharge Eliminating System (KPDES) Permit. Make and record inspections of BMPs and areas as required by the KPDES Permit. In the event of conflict between these requirements and pollution control laws, rules, or regulations of other Federal, State or Local agencies, adhere to the more restrictive laws, rules, or regulations.

1.2 RELATED WORK

- A. Section 02110 Site Clearing
- B. Section 02200 Earth and Rock Work
- C. Section 02936 Seeding

PART II - PRODUCTS

Not used

PART 3 - EXECUTION

As the permittee, submit the KPDES Notice of Intent (NOI) form to the Division of Water. Additionally, delegate in writing to Manager, KPDES Branch, who will have signature authority for reports. Provide the Engineer a copy of the NOI and a BMP Plan to represent and warrant compliance with the Kentucky Division of Water (KDOW) KPDES Permit, related rules, and specifications prior to starting work.

Locate, furnish, install, and maintain temporary sediment and erosion control best management practices (BMP) to represent and warrant compliance with the Clean Water Act, (33 USC Section 1251 et seq.), the 404 permit, the 401 Water Quality Certification, local government agency requirements, and other related rules and permits until the project has a formal release issued.

Provide the Engineer a copy of all weekly and rainfall event inspections as they are completed. Ensure all reports are signed by the delegated authority. keep a current BMP Plan and all inspection records available for public inspection as required by the KPDES Permit.

These provisions survive the completion and/or termination of the contract. The following provisions must be followed:

1. Take full responsibility and make all corrections when a governmental agency or a local governmental authority finds a violation of the above noted requirements; that the BMPs are incomplete; that the BMP Plan is incomplete; or that the implementation of the BMP Plan is not being performed correctly or completely.

2. Make payment to the Owner for the full amount, within 10 Calendar Days of notification, when a governmental agency or a local governmental authority furnishes an assessment, damage judgment or finding, fine, penalty, or expense for a violation of the above noted requirements; the BMPs being incomplete; or the BMP Plan being incomplete or its implementation not being performed correctly or completely. The Owner may withhold the amount of money requested for the above from the next pay estimate and deliver that sum to the governmental agency or local governmental authority issuing the assessment, damage judgment or finding, fine, penalty or expense.

3. Indemnify and hold harmless the Department, and reimburse the Department for any assessments, damage judgment or finding, fine, penalty, or expense as a result of the failure of performing this portion of the Contract. The Owner may withhold the amount of any assessments, damage judgments or finding, fine, penalty or expense from the next pay estimate.

4. The Owner will find the Contract in default if a governmental agency or a local governmental authority furnishes a stop work order for any of the following: a violation of the above noted requirements, that the BMPs are incomplete, that the BMP Plan is incomplete, that the implementation of the BMP Plan is not being performed correctly or completely.

5. When the Owner or any government regulatory agency finds a violation of the above noted requirements, or that the BMPs are incomplete, or that the "BMP Plan is incomplete or that the implementation of the BMP Plan is not being performed correctly or completely, correct and mitigate the conditions within 48 hours of notification by the Owner or regulatory agency. Failure to correct non-compliant site conditions will result in the Owner applying a penalty of \$500 per day until corrective actions are completed.

Upon completion of the project, provide the Engineer with a copy of the submitted KPDES Notice of Termination (NOT) form. Retain all records for 3 years or provide them to the Engineer for retention.

End of Section

SECTION 02936 - SEEDING

PART 1 - GENERAL

1.01 Work Included

The work described herein shall consist of application of seed, fertilizer and agricultural limestone to establish turf.

PART 2 - PRODUCTS

2.01 Seed

Seed shall be of the following mixture:

Fine Lawn Fescue	60%
Bluegrass	25%
Perennial Rye	15%

Seed shall be applied uniformly at the rate of three pounds per 1,000 square feet.

2.02 Agricultural Limestone

Agricultural limestone shall have a minimum calcium carbonate equivalent of 90 percent and shall be ground to such a fineness that at least 90 percent will pass a 10-mesh sieve and at least 50 percent will pass a 60-mesh sieve. Agricultural ground limestone shall be from quarries approved by the Kentucky Department of Agriculture.

Agricultural limestone shall be applied uniformly at the rate of 100 pounds per 1,000 square feet.

2.03 Fertilizer

Fertilizer shall be commercial grade, free flowing, uniform in composition.

Fertilizer shall be 10-20-20 applied uniformly at the rate of 25 pounds per 1,000 square feet.

2.04 Mulch

Mulch shall be clean straw and shall be applied at a rate of 100 pounds per 1,000 square feet.

PART 3 - EXECUTION

3.01 Delivery, Storage and Handling

Fertilizer and limestone shall be delivered to the site in the original, unopened containers bearing the manufacturer's guaranteed chemical analysis, name, trade name, trademark, and conformance to State and Federal laws. In lieu of containers, fertilizer and limestone may be furnished in bulk and a certificate indicating the above information shall accompany each delivery.

Seed, limestone and fertilizer shall be kept in dry storage away from contaminants, insects and rodents.

3.02 Seeding

Seed shall be broadcast uniformly. The seed shall be covered to an average depth of 1/4 inch by means of spike-tooth harrow, cultipacker, no till drill or other approved device. Seed shall not be broadcast when winds are above 10 mph. Immediately after seeding, the entire area shall be firmed with a roller not exceeding 90 pounds for each foot of roller width and the soil moistened to a depth of 6-8 inches. If seeding is performed with a cultipacker-type seeder or if seed is applied in combination with hydromulching, rolling will not be required.

3.03 Maintenance

Seeded areas shall be protected and maintained by watering and replanting as may be necessary to produce a uniform stand of grass. Maintenance shall continue until a dense, uniform turf is established composed of the grasses specified and until acceptance, and shall include repair of damage caused by erosion.

End of Section

SECTION 03310 - CAST-IN-PLACE CONCRETE

PART 1 - GENERAL

A. The general provisions of the Contract, including General Conditions and Requirements, apply to the work of this section.

PART 2 - DESCRIPTION OF WORK

- A. Work includes furnishing, forming and placing of all concrete work as shown on the drawings, and specified herein, including the following:
 - 1. All anchor bolts required for anchoring steel columns to concrete installed only.
 - 2. All inserts, anchors, etc., that must be placed in forms for later attachment of work of other trades, except Mechanical-Electrical.
 - 3. Building-in of inserts, anchors, sleeves, etc., as furnished by the Mechanical-Electrical Contractors and Structural Steel Supplier.
 - 4. Expansion Joint Filler.
 - 5. Joint Filler and sealer at edge of slabs.
 - 6. Waterstops.
 - 7. Crushed stone fill under slabs on grade.
 - 8. Vapor barrier under slabs on grade.
 - a. 15 mil. polyethylene
 - b. Vapor Seal 1/8" Heavy Duty
 - 9. Curing Compound, Sealer and Hardener.
- B. The extent of cast-in-place concrete (CIP-Conc) work is shown on the drawings.
- C. The work includes providing cast-in-place concrete (CIP-Conc) consisting of portland cement, fine and coarse aggregate, water, and selected admixtures; combined, mixed, transported, placed, finished and cured as herein specified.

PART 3 - RELATED WORK SPECIFIED ELSEWHERE

- A. Concrete Formwork: Section 03110.
- B. Concrete Reinforcement: Section 03210.

PART 4 - CODES AND STANDARD

- A. Comply with the provisions of the following codes, specifications and standards, except as otherwise shown or specified.
 - 1. ACI 301 "Specifications for Structural Concrete for Buildings".
 - 2. ACI 318 "Building Code Requirements for Reinforced Concrete".
 - 3. ACI 304 "Recommended Practice for Measuring, Mixing, Transporting and Placing Concrete".
 - 4. ACI 311 "Recommended Practice for Concrete Inspection".

- B. Where provisions of the above codes and standards are in conflict with building code in force for this project, the building code shall govern.
- C. The Contractor shall employ, at his own expense, a testing laboratory experienced in design and testing of concrete materials and mixes to perform material evaluation tests and to design concrete mixes.
 - 1. Testing agency shall meet the requirements of ASTM E329.
- D. Selection of a testing laboratory is subject to the Architect's acceptance.
- E. The testing laboratory shall perform field quality control testing. The Contractor shall provide free access and facilities at any time during the progress of the work.
- F. Materials and installed work may require testing and retesting, as directed by the Architect, at any time during the progress of the work. Allow free access to material stockpiles and facilities at all times. Tests, including the retesting of rejected materials and installed work, shall be done at the Contractor's expense.

PART 5 - TESTS FOR CONCRETE MATERIALS

- A. For normal weight concrete, test aggregates by the methods of sampling and testing of ASTM C33.
- B. For portland cement, sample the cement and determine the properties by the methods of test of ASTM C150.
- C. Submit written reports to the Architect for each material sampled and tested, prior to the start of work. Provide the project identification name and number, date of report, name of contractor, name of concrete testing service, source of concrete aggregates, material manufacturer and brand name for manufactured materials, values specified in the referenced specification for each material, and test results. Indicate whether or not material is acceptable for intended use.

PART 6 - SUBMITTALS

- A. For information only, <u>submit 2 copies of manufacturer's specifications</u> with application and installation instructions for proprietary materials and items, including admixtures, bonding agents, waterstops, joint systems, chemical floor hardeners, and dry shake finish materials.
- B. Submit samples of materials as specified and as otherwise may be requested by the Architect, including names, sources and descriptions as required.
- C. Submit 2 copies of laboratory test reports for concrete materials and mix design tests. The Architect's review will be for general information only. Production of concrete to comply with specified requirements is the Contractor's responsibility.
- D. Provide materials certificates in lieu of materials laboratory test reports only when permitted by the Architect. Material certificates shall be signed by the material manufacturer and the Contractor, certifying that each material item complies with, or exceeds, the specified requirements.

E. <u>Delivery Tickets:</u> Furnish copies of delivery tickets for each load of concrete delivered to the site. Provide items of information as specified.

PART 7 - CONCRETE

A. All concrete shall conform and be designed, mixed, placed, tested and cured in accordance with the ultimate strength provisions of the American Concrete Institute Building Code. All concrete shall develop the following compressive strength in 28 days.

	Compressive Strength Concrete Schedule		
	Minimum 28-Day Compressive Strength	Max Min. Slump (inch)	Air Content (%)
All concrete not otherwise indicated	3,500	4-1	2%-4%
Exterior slabs	4,000	3-1	4%-7%

PART 8 - CONCRETE MATERIALS

- A. Portland Cement: ASTM C 150, as follows:
 - 1. <u>Provide Type 1 cement</u>, except as otherwise indicated. Type 3 cement may be used in lieu of Type 1 at Contractor's option, when acceptable to the Architect.
 - 2. <u>Provide Type 3 cement</u> for High-Early Strength concrete for exterior concrete when acceptable to the Architect.
- B. Use only one brand of cement for each required type throughout the project, unless otherwise accepted by the Architect.
- C. <u>Aggregates:</u> ASTM C 33, and as herein specified.
 - 1. Local aggregates not complying with ASTM C 33 but which have shown by special test or actual service to produce concrete of adequate strength and durability may be used when acceptable to the Architect.
 - 2. Do not use aggregates containing soluble salts or other substances such as iron sulfides, pyrite, marcasite or ochre which can cause stains on exposed concrete surfaces.
 - 3. <u>Fine Aggregate:</u> Clean, sharp, natural sand free from loam, clay, lumps or other deleterious substances.
 - 4. Dune sand, bank run sand and manufactures sand are not acceptable.
 - 5. <u>Coarse Aggregate:</u> Clean, uncoated, processed aggregate containing no clay, mud, loam, or foreign matter.
 - 6. <u>Crushed stone</u>, processed from natural rock or stone.
 - 7. <u>Washed gravel</u>, either natural or crushed. Use of pit or bank run gravel is not permitted.

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- 8. <u>Maximum Aggregate Size:</u> Not larger than one-fifth of the narrowest dimension between sides of forms, one-third of the depth of slabs, nor three-fourths of the minimum clear spacing between individual reinforcing bars or bundles of bars.
- D. <u>Supply of Aggregates:</u> Provide aggregates from one source of supply to ensure uniformity in color, size and shape.
- E. <u>Water:</u> Clean, fresh, drinkable.
- F. Provide admixtures produced by established reputable manufacturers and use in compliance with the manufacturer's printed directions. Do not use admixtures which have not been incorporated and tested in the accepted mixes, unless otherwise authorized in writing by the Architect.
 - 1. Air-Entraining Admixtures: ASTM C 260.
 - 2. Water-Reducing Admixture: ASTM C 494, Type A.
- G. <u>Calcium Chloride</u>: Do not use calcium chloride in concrete, unless otherwise authorized in writing by the Architect. Do not use admixtures containing calcium chloride where concrete is placed against galvanized steel, or in mix using high-early strength cement.

PART 9 - PROPORTIONING AND DESIGN OF MIXES

- A. Prepare design mixes for each type of concrete. Use an independent testing facility acceptable to the Architect for preparing and reporting proposed mix designs.
- B. <u>Proportion mixes</u> by either laboratory trial batch or field experience methods, using materials to be employed on the project for each class of concrete required, complying with ACI 211.1 and report to the Architect the following data:
 - 1. Complete identification of aggregate source of supply.
 - 2. Tests of aggregates for compliance with specified requirements.
 - 3. Scale weight of each aggregate.
 - 4. Absorbed water in each aggregate.
 - 5. Brand, type and composition of cement.
 - 6. Brand, type and amount of each admixture.
 - 7. Amounts of water used in trial mixes.
 - 8. Proportions of each material per cu. yd.
 - 9. Gross weight and yield per cu. yd of trial mixtures.
 - 10. Measured slump.
 - 11. Measured air content.
 - 12. Compressive strength developed at least 7 days and 28 days, from not less than 3 test cylinders cast for each 7 and 28-day test, and for each design mix.
- C. <u>Submit written reports</u> to the Architect of each proposed mix for each type of concrete at least 15 days prior to start of work. Do not begin concrete production until mixes have been reviewed by the Architect.
- D. <u>Laboratory Trial Batches:</u> When laboratory trial batches are used to select concrete proportions, prepare test specimens in accordance with ASTM C 192 and conduct strength tests in accordance with ASTM C 39, as specified in ACI 30l.

- E. Establish a curve showing relationship between water-cement ratio (or cement content) and compressive strength, with at least 3 points representing batches which produce strengths above and below that required. Use not less than 3 specimens tested at 28-days, or an earlier age when acceptable to the Architect, to establish each point on the curve.
- F. <u>Field Experience Method:</u> When field experience methods are used to select concrete proportions, establish proportions as specified in ACI 30l.
- G. Strength data for establishing standard deviation will be considered suitable if the concrete production facility has certified records consisting of at least 30 consecutive tests in one group or the statistical average for 2 groups totaling 30 or more tests, representing similar materials and project conditions.
 - 1. <u>Standard Deviation</u>: If standard deviation exceeds 600 psi or if no suitable records available, select proportions to produce an average strength of at least 1200 psi greater than the required compressive strength concrete.
 - 2. After sufficient experience and test data become available from the job, using ACI 214 methods of evaluation, the standard deviation may be reduced when the probable frequency of tests more than 500 psi below required compressive strength will not exceed 1 in 100, and that the probable frequency of an average of 3 consecutive tests below required compressive strength will not exceed 1 in 100.
- H. <u>Adjustment to Concrete Mixes:</u> Mix design adjustments may be requested by the Contractor when characteristics of materials, job conditions, weather, test results, or other circumstances warrant; at no additional cost to the Owner and as accepted by the Architect. Laboratory test data for revised mix designs and strength results must be submitted to and accepted by the Architect before using in the work.
- I. <u>Use air-entraining admixture</u> in exterior exposed concrete, unless otherwise shown or specified. Add air-entraining admixture at the manufacturer's prescribed rate to result in concrete at the point of placement having air content within the following limits:
 - 1. <u>Concrete structures</u> and slabs exposed to freezing and thawing or subjected to hydraulic pressure:
 - a. 4% for maximum 2" aggregate.
 - b. 6% for maximum 3/4" aggregate.
 - c. 7% for maximum 1/2" aggregate.
 - 2. Other Exterior Concrete: 2% to 4% air.
- J. <u>Use amounts of admixtures</u> as recommended by the manufacturer for climatic conditions prevailing at the time of placing. Adjust quantities and types of admixtures as required to maintain quality control
- K. Proportion and design mixes to result in concrete slump at the point of placement as follows:
 - 1. <u>Ramps and Sloping Surfaces:</u> Not more than 3".
 - 2. <u>Reinforced Foundation Systems:</u> Not less than 1" and not more than 3".
 - 3. <u>All Other Concrete:</u> Not less than 1" and not more than 3".

PART 10 - CONCRETE MIXING

- A. Concrete may be mixed at batch plants or it may be transit-mixes as specified herein. Batch plants must comply with the requirements of ACI 304, with sufficient capacity to produce concrete of the qualities specified in quantities required to meet the construction schedule. All plant facilities are subject to testing laboratory inspection and acceptance of the Architect.
- B. Comply with the requirements of ASTM C 94, and as herein specified, provided the quantity and rate of delivery will permit unrestricted progress of the work in accordance with the placement schedule. During hot weather, or under conditions contributing to rapid setting of concrete, a shorter mixing time than specified in ASTM C 94 may be required, as specified below. Proposed changes in mixing procedures, other than herein specified, must be accepted by the Architect before implementation.
 - 1. <u>Plant equipment and facilities:</u> Conform to National Ready-Mix Concrete Association "Check List for Certification of Ready-Mixed Concrete Production Facilities.
- C. Modifications to ASTM C 94 are as follows:
 - 1. Quality of Concrete: Provide concrete materials, proportions, and properties as herein specified, in lieu of ASTM Section 4.
 - 2. <u>Tolerances in Slump</u>: Provide slump of not more than the values as herein specified, in lieu of ASTM Section 5.1. Comply with other criteria of ASTM Section 5.
 - 3. <u>Mixing and Delivery</u>: Delete the references for allowing additional water to be added to the batch for material with insufficient slump. Addition of water to the batch will not be permitted as specified in ASTM Section 9.7, when the air temperature is between 85 degrees F. and 90 degrees F., reduce the mixing and delivery time to 60 minutes. When a truck mixer is used for the complete mixing of the concrete, begin the mixing operation within 30 minutes after the cement has been intermingled with the aggregates.
 - 4. <u>Certification:</u> Furnish duplicate delivery tickets with each load of concrete delivered to the site, one for the Architect and one for the Contractor. In addition to the requirements of ASTM Section 14.1, provide the following information on delivery tickets:
 - a. Type and brand of cement.
 - b. Cement content per cu. yd. of concrete.
 - c. Maximum size of aggregate.
 - d. Amount and brand name of each admixture.
 - e. Total water content expressed as water/cement ratio.
 - 5. <u>Strength:</u> Delete ASTM Section 15; comply with concrete testing requirements as herein specified.
- D. Maintain equipment in proper operating condition, with drums cleaned before charging each batch. Schedule rates of delivery in order to prevent delay of placing the concrete after mixing, or holding dry-mixed materials too long in the mixer before the addition of water and admixtures.
PART 11 - FIELD QUALITY CONTROL

- A. Perform sampling and testing for field quality control during the placement of concrete, as follows:
 - 1. <u>Sampling Fresh Concrete:</u> ASTM C 172, except modified for slump to comply with ASTM C 94.
 - 2. <u>Slump:</u> ASTM C 143; one test for each concrete load at point of discharge; and one for each set of compressive strength test specimens.
 - 3. <u>Air Content:</u> ASTM C 231, pressure method; one for every other concrete load at point of discharge, or when the indicating of change requires.
 - 4. <u>Compression Test Specimens:</u> ASTM C 31; one set of 4 standard cylinders for each compressive strength test, unless otherwise directed.
 - a. Cast and store cylinders for laboratory cured test specimens and field-cured test specimens as specified in ASTM C 31.
 - 5. <u>Concrete Temperature:</u> Test hourly when air temperature is 40 degrees F. and below, and when 80 degrees F. and above and each time a set of compression test specimens made.
 - 6. <u>Compressive Strength Tests</u>: ASTM C 39; one set for each 25 cu. yds. or fraction thereof, of each mix design placed in any one day; 1 specimen tested at 7 days, 2 specimens tested at 28 days, and one specimen retained in reserve for later testing if required.
 - a. When the frequency of testing will provide less than 5 strength tests for a given mix design, conduct testing from at least 5 randomly selected batches or from each batch if fewer than 5 are used.
 - b. When the strength of field-cured cylinders is less than 85% of companion laboratory-cured cylinders, evaluate current operations and provide corrective procedures for protecting and curing the in-place concrete.
- B. Report test results in writing to the Architect, Contractor, and Ready-Mix supplier on the same day that tests are made. Reports of compressive strength tests shall contain the project identifications name and number, date of concrete placement, name of contractor, name of concrete supplier and truck number, name of concrete testing service, concrete type and class, location of concrete batch in the structure, design compressive strength at 28 days, concrete mix proportions and materials; compressive breaking strength and type of break for both 7-day tests and 28-day tests.
- C. The testing service will make additional tests of in-place concrete when test results indicate the specified concrete strengths and other characteristics have not been attained in the structure, as directed by the Architect. The testing service shall conduct tests to determine the strength and other characteristics of the in-place concrete by compression tests on cored cylinders complying with ASTM C 42, or by load testing specified in ACI 381, or other acceptable non-destructive testing methods, as directed. The Contractor shall pay for such tests conducted, and any other additional testing as may be required, when unacceptable concrete is verified.

- D. Do not use concrete delivered to the final point of placement which has slump or total air content outside the specified values.
- E. Compressive strength tests for laboratory-cured cylinders will be considered satisfactory is the averages of all sets of three consecutive compressive strength tests results equal or exceed the 28-day design compressive strength of the type or class of concrete; an, no individual strength test falls below the required compressive strength by more than 500 psi.
- F. Strength tests of specimens cured under field conditions may be required by the Architect to check the adequacy of curing and protection of the concrete places. Specimens shall be molded by the filed quality control laboratory at the same time and from the same samples as the laboratory cured specimens.
- G. Provide improved means and procedures for protecting concrete when the 28-day compressive strength of field-cured cylinders is less than 85% of companion laboratory-cured cylinders.
- H. When laboratory-cured cylinder strengths are appreciably higher than the minimum compressive strength, field-cured cylinder strengths need not exceed the minimum required compressive strength by more than 500 psi even though the 85% criterion is not met.
- I. If individual tests of laboratory-cured specimens produce strengths more than 500 psi below the required minimum compressive strength, or if tests of field-cured cylinders indicate deficiencies in protection curing, provide additional measures to assure that the load-bearing capacity of the structure is not jeopardized. If the likelihood of low-strength concrete is confirmed and computations indicate the load-bearing capacity may have been significantly reduced, tests of cores drilled from the area in question may be required.
- J. If the compressive strength tests fail to meet the minimum requirements specified, the concrete represented by such tests will be considered deficient in strength and subject to additional testing as herein specified.

PART 12 - FORMED CONCRETE DIMENSIONAL TOLERANCES

- A. Formed concrete having any dimension smaller or greater than required, and outside the specified tolerance limits, will be considered deficient in strength and subject to additional testing as herein specified.
- B. Formed concrete having any dimension greater than required will be rejected if the appearance or function of the structure is adversely affected, or if the larger dimensions interfere with other construction. Repair, or remove and replace rejected concrete as required to meet the construction conditions. When permitted, accomplish the removal of excessive material in a manner to maintain the strength of the section without affecting function and appearance.

PART 13 - STRENGTH OF CONCRETE STRUCTURES

A. The strength of the concrete structure in-place will be considered potentially deficient if it fails to comply with any of the requirements which control the strength of structure, including the following conditions.

- 1. Failure to meet compressive strength tests requirements.
- 2. Concrete which differs from the required dimensions or location in such a manner to reduce strength.
- 3. Concrete subjected to damaging mechanical disturbances; particularly load stresses, heavy shock, and excessive vibration.
- 4. Poor workmanship and quality control likely to result in deficient strength.
- B. When there is evidence that the strength of the concrete structure in-place does not meet specification requirements, the concrete testing service shall take cores drilled from hardened concrete for compressive strength determination, complying with ASTM C 42 and as follows:
 - 1. Take at least 3 representatives cores from each member or area or suspect strength, from locations directed by the Architect.
 - 2. Test cores in a saturated-surface-dry condition per ACI 318 if the concrete will be wet during the use of the completed structure.
 - 3. Test cores in an air-dry condition per ACI 318 if the concrete will be dry at all times during use of the completed structure.
 - 4. Strength of concrete for each series of cores will be considered satisfactory if their average compressive strength is at least 85% and no single core is less than 75% of the 28-day required compressive strength.
 - 5. Report test results in writing to the Architect on the same day that tests are made. Include in test reports the project identification name and number, date, name of contractor, name of concrete testing service, location of test core sample, nominal maximum size aggregate, design compressive strength, compression breaking strength and type of break (corrected for length-diameter ratio) direction of applied load to core with respect to horizontal plane of the concrete as placed, and the moisture condition of the core at time of testing.
 - 6. Fill core holes solid with patching mortar, and finish to match adjacent concrete surfaces.
 - 7. Conduct static load test and evaluations complying with ACI 318 if the results of the core tests are unsatisfactory, or if core tests are impracticable to obtain, as directed by the Architect.
- C. Concrete work which does not conform to the specified requirements, including strength, tolerances, and finishes, shall be corrected at the Contractor's expense, without extension of time therefore. The Contractor shall also be responsible for the cost of corrections to any other work affected by or resulting from corrections to the concrete work.

PART 14 - JOINT MATERIALS

- A. Preformed Expansion Joint Fillers: Type 1 Standard highly resilient.
- B. Joint Sealing Compound: Polysulfide sealants, elastomeric caulk; Hornflex by Construction Products Division, W.R. Grace & Company, Sonneborn by ChemRex, LLC, or an approved equal.

PART 15 - MOISTURE BARRIER

- A. Provide moisture barrier cover over prepared base material where shown on drawings. Use only materials which are resistant to decay when tested in accordance with ASTM E 154, as follows:
 - 1. <u>Polyethylene sheet</u> not less than 10 mils thick.
 - 2. Water resistance barrier paper consisting of heavy Kraft paper laminated together with glass fiber reinforcement and overcoated with black polyethylene on each side.

PART 16 - BONDING AGENT

- A. <u>Chemical Bonding Agent:</u> Film-forming, freeze-thaw resistant compound suitable for brush or spray application complying with Mil B-19235.
- B. Provide concrete bonding agent as manufactured by one of the following or approved equal.
 - 1. Polyweld; Chem-Master Corp.
 - 2. Daraweld-PBA; W,R, Grace

PART 17 - FLOOR FINISH MATERIALS

- A. <u>Chemical Floor Hardener (ChHd-Fn)</u>: Colorless, transparent, oil free moisture, sodium silicate or polyurethane seals, dust proofs, hardens interior concrete floors. Place on floor slab concrete and slab on grades, interior concrete floors only.
 - 1. Apply to exposed concrete slabs not indicated or scheduled to receive subsequent finishes.
 - 2. Products offered by manufacturers to comply with the requirements for colorless liquid chemical floor hardener include the following or an approved equal:
 - a. Sonsothane Sonneborn-Contech
 - b. Horn One-Kote A.C. Horn/W. R. Grace & Co.
 - c. Lithoplate; Protex Industries
- B. Under no circumstances shall dry cement or mixture of cement and sand be used to absorb surface moisture or to stiffen surface to be finished. See manufacturer's recommendation for curing and sealant.

- C. <u>Hard Steel Trowel Finish</u> After slab concrete has been placed, surface shall be brought to established grade, with straight-edge and bull floated to "smooth out" surface. When water sheen has disappeared, surface shall be floated with power and/or wood floats. After floating with power and no water appears when trowel is operated, surface shall be troweled until smooth hard surface is obtained free of pin holes and other imperfections. All hard trowel finishes shall be treated with a one component, oil free, polyurethane sealer and hardener applied in strict accordance with the manufacturer's recommendations, and specifications for structural concrete for buildings ACI 301-72, Chapter 11 Slabs, Exposed.
- D. This Contractor shall take care to protect concrete work and finished concrete during construction. If work is damaged or finished surfaces marred by subsequent construction, this Contractor shall restore to rebuild concrete work to satisfaction of the Architect and remove damaged materials from site at this Contractor's expense.
- E. Work on slabs on grade shall begin only after earth subgrade has been thoroughly compacted as described under another Section of the Specifications, after pipes and drains to be located under slabs are placed, tested and approved.
- F. Work under this Section includes furnishing, placing and compacting of clean porous fill of washed gravel or crushed stone under slabs on grade. Porous fill shall be 6" thick and shall be compacted by rollers and by machine driven tampers or by mechanical vibration. Fill shall be free from protrusions which would puncture vapor barrier.
- G. At edge of interior slabs adjoining foundation walls and at all other places where floor slab is pierced, provide joint filler and sealer as specified herein.

PART 18 - CONTROL JOINTS

A. Form control joints in concrete wall where shown and as detailed on the Drawings.

PART 19 - CONCRETE CURING MATERIALS

- A. <u>Absorptive Cover:</u> Burlap cloth made from jute or kenaf, weighing approximately 9 oz. per sq. yd. and complying with AASHO M 182, Class 3.
- B. <u>Moisture-Retaining Cover:</u> One of the following, complying with ASTM C 171: Waterproof Paper Polyethylene Film White Burlap-Polyethylene Sheet
- C. <u>Liquid Membrane-Forming Curing Compound</u>: Liquid type membrane-forming curing compound complying with ASTM C 309, Type 1, unless other type acceptable to the Architect.

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 Products offered by manufacturers to comply with the requirements for membrane-forming curing compounds include the following or an approved equal: Masterseal; Master Builder's Co. Clear Seal; A.C. Horn/W.R. Grace Kure-N-Seal; Sonneborn-Contech Polyclear; Upco Chemical/USM Corp. Clear Cure; L&M Construction Chemicals Klearseal; Castle Chemical Corp. LR-151; Protect Industries

PART 20 - PREPARATION

- A. Before placing concrete, inspect and complete the form work installation, reinforcing steel, and items to be embedded or cast-in. Notify other crafts involved in ample time to permit the installation of their work; cooperate with other trades in setting such work, as required.
- B. Forms shall be constructed of materials as indicated for use and purpose intended. See Architect's Drawings also.
- C. <u>Coordinate</u> the installation of joint materials and moisture barriers with placement of forms and reinforcing steel.

PART 21 - CONCRETE PLACEMENT

- A. Place concrete in compliance with the practices and recommendations of ACI 304, and as herein specified.
- B. Deposit concrete continuously or in layers of such thickness that no concrete will be placed on concrete which has hardened sufficiently to cause the formation of seams or planes of weakness within the section. If a section cannot be placed continuously, provide construction joints as herein specified. Perform concrete placing at such a rate that concrete which is being integrated with fresh concrete is still plastic. Deposit concrete as nearly as practicable to its final location to avoid segregation due to handling or flowing. Do not subject concrete to any procedure which will cause segregation.
- C. Screed concrete which it is to receive other construction to the proper level to avoid excessive skimming or grouting.
- D. Do not use concrete which becomes non-plastic and unworkable, or does not meet the required quality control limits, or which has been contaminated by foreign materials. Do not use re-tempered concrete. Remove rejected concrete from the project site and dispose of in an acceptable location.
- E. Handle concrete from the point of delivery and transfer to the concrete conveying equipment and to the locations of final deposit as rapidly as practicable by methods which will prevent segregation and loss of concrete mix materials.

- F. Provide mechanical equipment for conveying concrete to ensure a continuous flow of concrete at the delivery end. Provide runways for wheeled concrete conveying equipment from the concrete delivery point to the locations of final deposit. Keep interior surfaces of conveying equipment, including chutes, free of hardened concrete, debris, water, snow, ice, and other deleterious materials.
- G. Deposit concrete in forms in horizontal layers not deeper than 24" and in a manner to avoid inclined construction joints. Where placement consists of several layers, place each layer while preceding layer is still plastic to avoid cold joints.
- H. Remove temporary spreaders in forms when concrete placing has reached the elevation of such spreaders.
- I. Consolidate concrete placed in forms by mechanical vibrating equipment supplemented by hand-spading, rodding or tamping. Use equipment and procedures for consolidation of concrete in accordance with the recommended practices of ACI 309, to suit the type of concrete and project conditions. <u>Vibration of forms and reinforcing will not be permitted</u>, unless otherwise accepted by the Architect.
- J. Do not use vibrators to transport concrete inside of forms. Insert and withdraw vibrators vertically at uniformly spaced locations not farther than the visible effectiveness of the machine. Place vibrators to rapidly penetrate the layer of concrete that have begun to set. At each insertion, limit the duration of vibration to the time necessary to consolidate the concrete and complete embedment of reinforcement and other embedded items without causing segregation of the mix.
- K. Consolidate concrete during placing operations using mechanical vibrating equipment, so that concrete is thoroughly worked around reinforcement and other embedded items and into corners.
- L. Bring slab surfaces to the correct level with a straight edge and strike off. Use bull flats or darbies to smooth the surface. Do not disturb the slab surfaces prior to beginning finishing operations.
- M. Maintain reinforcing steel in the proper position continuously during concrete placement operations.

PART 22 - BONDING

A. Roughen surfaces of set concrete at all joints, except where bonding is obtained by use of a concrete bonding agent, and clean surfaces of laitance, coatings, loose particles, and foreign matter. Roughen surfaces in manner to expose bonded aggregate uniformly and not to levee laitance, loose particles of aggregate, or damaged concrete at the surface.

PART 23 - EXTERIOR AND INTERIOR WALLS

A. Grout air holes with mortar. Remove excess grout. Patches shall be ground to produce uniform surfaces, free of blemished and fins to the satisfaction of the Architect. Patches shall be kept continuously moist for a period minimum of six days.

- B. Fill tie holes after form oil have evaporated sufficiently for good bond as specified for patching operation above. Exposed walls shall receive a rubbed finish.
- C. At completion, concrete shall be of uniform texture and finish.

PART 24 - COLD WEATHER PLACING

- A. Protect all concrete work from physical damage or reduced strength which could be caused by frost, freezing actions, or low temperatures, in compliance with the requirements of ACI 306 and as herein specified.
- B. When the air temperature has fallen to or is expected to fall below 40 degrees F., provide adequate means to maintain the temperature in the area where concrete is being placed at either 70 degrees F for 3 days or 50 degrees F for 5 days after placing. Provide temporary housings or coverings including tarpaulins or plastic film. Keep protections in place and intact at least 24 hours after artificial heat is discontinued. Avoid rapid dry-out of concrete due to overheating, and avoid thermal shock due to sudden cooling or heating.
- C. When air temperature has fallen to or is expected to fall below 40 degrees F. uniformly heat all water and aggregates before mixing as required to obtain a concrete mixture temperature of not less than 50 degrees F. and not more than 80 degree F. at point of placement.
- D. Do not use frozen materials containing ice or snow. Do not place concrete on frozen subgrade or on subgrade containing frozen materials. Ascertain that forms, reinforcing steel, and adjacent concrete surfaces are entirely free of frost, snow and ice before placing concrete.
- E. Do not use calcium chloride, salt, and other materials containing antifreeze agents or chemical accelerators.

PART 25 - HOT WEATHER PLACING

- A. When hot weather conditions exist that would seriously impair the quality and strength of concrete, place concrete in compliance with ACI 305 and as herein specified.
- B. Cool ingredients before mixing to maintain concrete temperature at time of placement below 90 degrees F. Mixing water may be chilled, or chopped ice may be used to control the concrete temperature provided the water equivalent of the ice is calculated to the total amount of mixing water.
- C. Cover reinforcing steel with water-soaked burlap if it becomes too hot, so that the steel temperature will not exceed the ambient air temperature immediately before embedment in concrete.
- D. Wet forms thoroughly before placing concrete.
- E. Use set-control admixtures when required and accepted in mix designs.

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PART 26 - CONSTRUCTION JOINTS

- A. Locate and install construction joints, which are not shown on the drawings, so as not to impair strength and appearance of the structure, as acceptable to the Architect. Locate construction joints, if required but not shown as follows:
 - 1. In slabs on ground, so as to divide the slab into areas not in excess of 1200 sq.ft., unless otherwise accepted by the Architect. Conform to slab placement diagrams or pattern layout for placement, where shown.
- B. Provide keyways at least 1¹/₂" deep in all construction joints in walls, slabs, and between walls and footings.
- C. Place construction joints perpendicular to the main reinforcement. Continue all reinforcement across construction joints.

PART 27 - ISOLATION JOINTS IN SLABS ON GROUND

- A. Provide isolation joints in slabs on ground at all points of contact between slabs on ground and vertical surfaces, such as foundation walls, grade beams, and elsewhere as indicted.
- B. Provide control joints in slabs on ground to form panels or patterns as shown. Use inserts $\frac{1}{4}$ wide x $1\frac{1}{4}$ deep below the slab surface, after the concrete has cured for at least 7 days.

PART 28 - FINISH OR FORMED SURFACES

- A. Provide as-cast rough form finish to formed concrete surfaces that are to be concealed in the finish work or by other construction, unless otherwise indicated.
- B. Standard form finish shall be the concrete surface having the texture imparted by the form facing material used, with the holes and defective areas repaired and patched and all fins and other projections exceeding 1/4" in height rubbed down or chipped off.
- C. Provide smooth rubbed (SmRbd-Fn) to front exterior exposed concrete surfaces, which have received smooth form finish treatment, not later than the day after form removal.
- D. At tops of walls, horizontal offsets, and similar unformed surfaces occurring adjacent to formed surfaces, strike off smooth and finish with a texture matching the adjacent formed surfaces. Continue the final surface treatment of formed surfaces uniformly across the adjacent unformed surfaces, unless otherwise shown.
- E. After placing concrete slabs, do not work the surface further until ready for floating. Begin floating when the surface water has disappeared or when the concrete has stiffened sufficiently to permit the operation of a power-driven float, or both. Consolidate the surface with power-driven floats, or by hand-floating if area is small or inaccessible to power units. Check and level the surface plane to a tolerance not exceeding l/4" in 10' when tested with a 10' straightedge placed on the surface at not less than 2 different angles. Cut down high spots and fill all low spots. Uniformly slope surfaces to drains. Immediately after leveling, refloat the surface to a uniform smooth, granular texture.

PART 29-CHEMICAL-HARDENER FINISH: INTERIOR FLOOR TOPPING CONCRETE

- A. Apply chemical-hardener finish to dry interior concrete floors where shown on the drawings or in schedules. Apply liquid chemical-hardener after complete curing and drying of the concrete surface. Dilute the liquid hardener with water, and apply in 3 coats; 2/3 strength. Evenly apply each coat, and allow 24 hours for drying between coats.
- B. Apply proprietary chemical hardeners in accordance with the manufacturer's printed directions.
- C. After the final coat of chemical-hardener solution is applied and dried, remove surplus hardener by scrubbing and mopping with water.

PART 30 - CONCRETE CURING AND PROTECTION

- A. Protect freshly placed concrete from premature drying and excessive cold or hot temperature, and maintain without drying at a relatively constant temperature for the period of time necessary for hydration of the cement and proper period of time necessary for hydration of the cement and proper handling of the concrete.
- B. Start initial curing as soon as free moisture has disappeared from the concrete surface after placing and finishing. Weather permitting, keep continuously moist for not less than 72 hours.
- C. Begin final curing procedures immediately following initial curing and before the concrete has dried. Continue final curing for at least 7 days and in accordance with ACI 301 procedures. Avoid rapid drying at the end of the final curing period.

PART 31 - CURING METHODS

- A. Perform curing of concrete by moist curing, by moisture-retaining cover curing, by membrane curing, or by combinations thereof, as herein specified, optional to the Contractor with approval from the Architect.
 - 1. For curing, use only water that is free of impurities which could etch or discolor exposed, natural concrete surfaces.
 - 2. Keeping the surface of the concrete continuously wet by covering with water.
 - 3. Continuous water-fog spray.
 - 4. Covering the concrete surface with the specified absorptive cover, thoroughly saturating the cover with water, and keeping the absorptive continuously wet. Place absorptive cover so as to provide coverage of the concrete surfaces and edges, with a 4" lap over adjacent absorptive covers.

- 5. Cover the concrete surfaces with the specified moisture-retaining cover for curing concrete, placed in the widest practicable width with sides and ends lapped at least 3" and sealed by waterproof tape or adhesive. Immediately repair any holes or tears during the curing period using cover material and waterproof tape.
- 6. Apply the specified membrane-forming curing compound to damp concrete surfaces as soon as the water film has disappeared. Apply uniformly in a 2-coat continuous operation by power spray equipment in accordance with the manufacturer's directions. Recoat areas which are subjected to heavy rainfall within 3 hours after initial application. Maintain the continuity of the coating and repair damage to the coat during the entire curing period.
- 7. Do not use membrane curing compounds on surfaces which are to be covered with a coating material applied directly to the concrete or with a covering material bonded to the concrete, such as other concrete, liquid floor hardener, waterproofing, damp proofing, membrane roofing, flooring, painting and other coatings and finish materials, unless otherwise acceptable to the Architect.

PART 32 - CURING FORMED SURFACES

A. Cure formed concrete surfaces, including the undersides of girders, joist, beams, supported slabs and other similar surfaces by moist curing with the forms in place for the full curing period or until forms are removed. If forms are removed, continue curing by methods specified above, as applicable.

PART 33 - CURING UNFORMED SURFACES

- A. Initially cure unformed surfaces, such as slabs and other flat surfaces by moist curing, whenever possible.
- B. Final cure unformed surfaces, unless otherwise specified, by any of the methods specified above, as applicable.
- C. Final cure concrete surfaces to receive liquid floor hardener or finish flooring by use of moisture-retaining cover, unless otherwise acceptable to the Architect.

PART 34 - FINAL CURING OF CONCRETE

A. During the curing period, protect concrete from damaging mechanical disturbances including load stresses, heavy shock, excessive vibration, and from damage caused by rain or flowing water. Protect all finished surfaces from damage by subsequent construction operations.

PART 35 - MISCELLANEOUS CONCRETE ITEMS

A. Provide concrete grout for reinforced masonry lintels door jambs and bond beams where indicated on drawings and as scheduled. Maintain accurate location of reinforcing steel during concrete placement.

- B. Fill-in holes and opening left in concrete structures for the passage of work by other trades, unless otherwise shown or directed, after the work of other trades is in place. Mix, place and cure concrete as herein specified, to blend with in-place construction. Provide all other miscellaneous concrete filling shown or required to complete the work.
- C. Place dove tail slots in all concrete surfaces where concrete and masonry wallsconnect.
- D. The concrete in each integral unit of the structure shall be placed continuously, and the Contractor shall not begin work without sufficient approved material on hand nor without sufficient forces and equipment to complete that unit without interruption in placing the concrete.
- E. Reinforce all walls, unless otherwise specified or shown on the drawings, with number five (5) bars at 12 inches on centers horizontal and vertical.
- F. Provide monolithic finish to interior curbs by stripping forms while concrete is still green and steel-troweling surfaces to a hard, dense finish with corners, intersections, and terminations slightly rounded.
- G. <u>Equipment Bases and Foundations</u>: Provide machine and equipment bases and foundations, as shown on the drawings. Set anchor bolts for machines and equipment to template at correct elevations, complying with certified diagrams or templates of the manufacturer furnishing the machines and equipment.

PART 36 - CONCRETE SURFACE REPAIRS

- A. Repair and patch defective areas with cement mortar <u>immediately</u> after removal of forms, but only when directed by the Architect.
- B. Cut out honeycomb, rock pockets, voids over l/2" diameter, and holes left by tie rods and bolts, down to solid concrete but, in no case, to a depth of less than l". Make edges of cuts perpendicular to the concrete surface. Before placing the cement mortar, thoroughly clean, dampen with water, and brush-coat the area to be patched with neat cement grout. Proprietary patching compounds may be used when acceptable to the Architect.
- C. For exposed-to-view-surfaces, blend white portland cement and standard portland cement so that, when dry, the patching mortar will match the color of the surrounding concrete. Provide test areas at inconspicuous location to verify mixture and color match before proceeding with the patching. Compact mortar in place and strike off slightly higher than the surrounding surface.
- D. Fill holes extending through concrete by means of a plunger-type gun or other suitable device from the least exposed face, using a flush stop held at the exposed face to ensure complete filling.

- E. <u>Repair of Unformed Surfaces:</u> Test unformed surfaces, such as slabs, for smoothness and to verify surface plane to the tolerances specified for each surface and finish. Correct low and high areas as herein specified.
- F. Test unformed surfaces sloped to drain for trueness of slope, in addition to smoothness, using a template having the required slope. Correct high and low areas as herein specified.
- G. Repair finished unformed surfaces that contain defects which adversely affect the durability of the concrete. Surface defects, as such, include crazing, cracks in excess of 0.01" wide or which penetrate to the reinforcement or completely through non-reinforced sections regardless of width, spalling, popouts, honeycomb, rock pockets, and other objectional conditions.
- H. Correct high areas in unformed surfaces by grinding, after the concrete has cured sufficiently so that repairs can be made without damage to adjacent areas.
- I. Correct low areas in unformed surfaces during, or immediately after completion of surface finishing operations by cutting out the low areas and replacing with fresh concrete. Finish repaired areas to blend into adjacent concrete. Proprietary patching compounds may be used when acceptable to the Architect.
- J. Repair defective areas, except random cracks and single holes not exceeding l" diameter, by cutting out and replacing with fresh concrete. Remove defective areas to sound concrete with clean, square cuts, and expose reinforcing steel with at least 3/4" clearance all around. Dampen all concrete surfaces in contact with patching concrete and brush with a neat cement grout coating, or use concrete bonding agent. Place patching concrete before grout takes its initial set. Mix patching concrete of the same type or class as the original adjacent concrete. Place, compact and finish as required to blend with adjacent finished concrete. Cure in the same manner as adjacent concrete.
- K. Repair isolated random cracks and single holes not over l" in diameter by the dry-pack method. Groove the top of cracks, and cut out holes to sound concrete and clean out dust, dirt and loose particles. Dampen all cleaned concrete surfaces and brush with a neat cement grout coating. Place dry-pack before the cement grout takes its initial set. Mix dry-pack, consisting of one part portland cement to 2½ parts fine aggregate passing a No. 16 mesh sieve, using only enough water as required for handling and placing. Compact dry-pack mixture in place and finish to match adjacent concrete. Keep patched areas continuously moist for not less than 72 hours.
- L. Repair methods not specified above may be used, subject to the acceptance of the Architect.

End of Section

SECTION 04200 - UNIT MASONRY (For Reference)

PART I - GENERAL

A. This Section includes all labor, materials, equipment, and related items required for the work of unit masonry as shown on the Drawings and as specified.

PART 2 - SUBMITTALS

A. Duplicate samples of the following shall be submitted to the Architect for approval prior to the delivery of such materials to the project site.

PART 3 - PRODUCT HANDLING

A. Store all masonry units on screeds and under cover to properly protect from the elements until ready for use. Dirty, cracked, chipped, or otherwise damaged masonry units shall not be used.

PART 4 - ENVIRONMENTAL CONDITIONS

A. Masonry shall not be laid in freezing weather unless suitable means are used to heat the materials and protect the work from cold and frost, and to ensure that the mortar will properly harden without freezing.

PART 5 - PROTECTION

A. The Contractor shall protect exposed masonry materials of every kind against staining, and the tops of all walls shall be kept covered with non-staining waterproof covering at the end of each work day and at any time the work thereon is not in progress. When starting or resuming work at a new level, the top surface of the work in place shall be cleaned of all loose mortar and foreign materials and in drying weather thoroughly wetted with clean water. Then resume laying.

PART 6 - MATERIALS

- A. Masonry Units:
 - Concrete block for general use throughout the project shall be hollow, load-bearing concrete masonry units complying with ASTM C90, Grade N-1, shall have nominal 8" x 16 face, or as shown, shall have a compressive strength of not less than 800 p.s.i. for individual units and an average of 1,000 for five units.
 - a. Exterior CMU shall be waterproof with waterproof mortar.
 - b. All aggregates for concrete masonry units shall conform to ASTM C331, and shall be expanded shale produced by the rotary kiln process.
 - c. All units shall be made with Portland cement complying with ASTM C150, and weighing not more than 100 lbs. per cubic foot.

- d. All units shall be square, true, and have sharp arriser. They shall be of consistent texture, and shall be dimensionally stable with regard to height, width, and lengths. All units shall be free of organic impurities that will cause rusting, staining, or pop-outs, and shall contain no combustible matter.
- e. Steam Curing. All concrete blocks shall be steamed in an atmosphere of 100° F. for a period of 4 to 6 hours. Steam curing shall commence after masonry units have been allowed to "set" for a period of 1½ to 2 hours. After steam curing, allow kiln temperature to drop slowly before removing blocks from kiln. Blocks shall be stored for a period of 30 days and protected from the weather during this period before delivery to site.
- B. Masonry Wall Reinforcement:
 - 1. Provide all prefabricated internal or external corners required by installation.
- C. Anchors and ties shall be of corrosion resistant metal equal in strength, size and numbers to conform with requirements of American standard A41.1 titled American Standard Building Code Requirements for Masonry.
 - 1. Truss type reinforcement for horizontal reinforcing at concrete masonry partitions. Reinforcement shall be Dur-O-Wall Truss No. 9 gauge cross rod or approved equal. All components of anchor to have a hot dipped galvanized finish. Place joint reinforcement directly on masonry and place mortar over wire to form bed joint.

PART 7 - LAYING CONCRETE BLOCK

- A. Lay all concrete block in exterior and interior wall construction where indicated, using Type N mortar furnished under work of Section 04100, except that Type S mortar shall be used in laying concrete block below grade.
- B. All bed and head joints shall be completely filled with mortar. Bed joints shall be filled by spreading a thick bed of mortar. Fill head joints with a heavy buttering of mortar on one side (each flange) of block, press the block down into the bed joint, and push the block into place so that the mortar squeezes out from the top and sides of the head joint. Mortar should correspondingly cover the end flange of the block before placing the next block. Attempting to fill joints by slushing or dashing will not be permitted. Partial filling of joints with mortar cut from the extruded bed joint will not be permitted. Where closures are required, fill with mortar so that the intersection of the closure will extrude mortar, both laterally and vertically. Extend walls and partitions to heights indicated, building in around joist bearings, etc. as shown or required. Cut units as required to properly course in plan and vertical section as shown on the Drawings or as directed by the Architect. All cuts shall be accurately made with masonry saw.
- C. Joints and Bond. All concrete masonry units shall be laid in running bond. Joints in concrete block work shall be 3/8" wide for both head and bed joints. Joints in masonry

scheduled to receive separate finish or where concealed in the work shall be cut flush. Rake joints 3/8" deep at control joints, where masonry abuts concrete surfaces, etc., and otherwise where shown on the Drawings, for caulking by others under work of Section 07900.

- D. Reinforcement. Concrete masonry walls and partitions shall be reinforced continuously in every other course, (l6" o.c. vertically) using masonry wall reinforcement of types as hereinbefore specified. Reinforcement shall be seated in the mortar bed by lifting cross ties as work progresses. Lay internal and external corners and intersections as required for the completed job.
- E. Chases for pipes, conduits, etc. shall be plumb and smooth on the inside, with offsets formed where required, kept free of obstructions and cleaned out on completion. There shall be at least 8" of masonry between chases and the jambs of openings.
- F. Build units accurately to metal door frames, building in anchors furnished with frames. Slush solid with mortar at jambs and head.
- G. Coordinate work with other trades, building in all items shown to be installed in concrete block work such as lintels, anchors, sleeves, etc. Prepare openings as shown or required for proper installation of mechanical, electrical, and other items.
- H. Cleaning. Extreme care shall be exercised during laying to protect units from mortar droppings, etc. Upon completion of work, all exposed concrete block shall be properly cleaned with a stiff bristle brush to remove all excess mortar, dirt and stains. Do not use acid.
- I. Workmanship. The contractor is cautioned that the Architect will demand first class workmanship. All concrete masonry work shall be performed by experienced masons. Any chipped, cracked or otherwise damaged or defective work will be rejected.

End of Section

SECTION 05120 - STRUCTURAL STEEL

PART 1 - GENERAL

1.01 DESCRIPTION

- A. Work included: Extent of Structural Steel work is shown on drawings, including schedules, notes and details to show size and location of members, typical connections, and type of steel required.
- B. Related Work:
 - 1. Documents affecting work of this Section include but are not necessarily limited to General Conditions, Supplementary Conditions, and Division 1 of these Specifications.

1.02 QUALITY ASSURANCE

- A. Codes and Standards: Comply with provision of following except as otherwise indicated.
 - 1. AISC "Code of Standard Practice"
 - 2. AISC "Specification for Structural Steel Buildings"
 - 3. AISI "Specification for the Design of Cold-Formed Steel Structural Members"
 - 4. AISC "Specification for Structural Joints using ASTM A325 or A490 Bolts"
 - 5. American Welding Society (AWS) D1.1 "Structural Welding Code-Steel".
- B. Qualifications for Welding Work: Qualify welding processes and welding operators in accordance with AWS "Standard Qualification Procedure".
 - 1. Provide certification that welders to be employed in work have satisfactorily passed AWS qualification tests.
- C. The fabricator shall maintain an agreement with an approved independent agency to conduct periodic in-plant inspections at the fabricator's plant to assure conformance to the requirements of the inspection agency's approved quality control program.
- D. Materials and fabrication procedures are subject to inspection and tests in mill, shop and field, conducted by a qualified inspection agency. Such inspections and tests will not relieve Contractor of responsibility for providing materials and fabrication procedures in compliance with specified requirements.
- E. Design of Members and Connections: Details shown are typical; similar details apply to similar conditions, unless otherwise indicated. Verify dimensions at site without causing delay in the work.

1.03 SUBMITTALS

A. Shop Drawings: Submit shop drawings including complete details and schedules for fabrication and assembly of structural steel members.

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- 1. Include details of cuts, connections, camber, holes, and other pertinent data. Indicate welds by standard AWS A2.1 and A2.4 symbols, and show size, length, and type of each weld.
- 2. Provide setting drawings, templates, and directions for installation of anchor bolts and other anchorages to be installed as work of other sections.
- B. Certificates of Compliance: Furnish manufacturer's certificate of compliance for the following:
 - 1. Bolts, nuts, washers
 - 2. Weld filler materials
- C. Mill test reports: Furnish certified mill test reports for all structural steel materials.
- D. In-Plant Inspections: Furnish certification from an approved independent inspection agency of inspections in conformance with these specifications.

1.04 DELIVERY, STORAGE AND HANDLING

- A. Deliver materials to site at such intervals to insure uninterrupted progress of work.
- B. Deliver anchor bolts and anchorage devices, which are to be embedded in cast-in-place concrete or masonry, in ample time to not delay work.
- C. Store materials to permit easy access for inspection and identification. Keep steel members off ground, using pallets, platforms, or other supports. Protect steel members and packaged materials from erosion and deterioration.
 - 1. Do not store materials on structure in a manner that might cause distortion or damage to members or supporting structures. Repair or replace damaged materials or structures as directed.

PART 2 - PRODUCTS

2.01 MATERIALS

- A. All wide flange structural steel to be ASTM A992, Grade 50. All other structural steel shapes, plates and bars to be ASTM A36 unless noted otherwise on the drawings.
- B. Cold-Formed steel tubing: ASTM A500, Grade B.
- C. Cold-Formed shapes: ASTM A242 Grade 50
- D. Steel pipe: ASTM A53, Type E or S, Grade B; or ASTM A501.
- E. Headed Stud-Type Shear Connectors: ASTM A108, Grade 1015 or 1020, cold finished carbon steel; with dimensions complying with AISC Specifications.
- F. Anchor Bolts: ASTM A307, non-headed type unless otherwise indicated.

- G. Unfinished Threaded Fasteners: ASTM A307, Grade A, regular low-carbon steel bolts and nuts.
- H. High Strength Threaded Fasteners: Heavy hexagon structural bolts, heavy hexagon nuts, and hardened washers, as follows:
 - 1. Quenched and tempered medium-carbon steel bolts, nuts and washers, complying with ASTM A325.
 - 2. Quenched and tempered alloy steel bolts, nuts and washers, complying with ASTM A490.
 - 3. Direct tension indicator washers may be used at Contractor's option.
- I. Electrodes for Welding: Comply with AWS Code.
- J. Structural Steel Primer Paint: SSPC Paint 13.

2.02 FABRICATION

- A. Shop Fabrication and Assembly: Fabricate and assemble structural assemblies in shop to greatest extent possible. Fabricate items of structural steel in accordance with AISC Specifications and as indicated on final shop drawings. Provide camber in structural members where indicated.
 - 1. Properly mark and match-mark materials for field assembly. Fabricate for delivery sequence which will expedite erection and minimize field handling of materials.
- B. Connections: Weld or bolt shop connections as indicated.
 - 1. Bolt field connections, except where welded connections or other connections are indicated.
 - 2. Provide high-strength threaded fasteners for principal bolted connections, except where unfinished bolts are indicated.
 - 3. Provide unfinished threaded fasteners for only bolted connections of secondary framing members to primary members (including purlins, girts, and other framing members taking only nominal stresses) and for temporary bracing to facilitate erection.
- C. High-Strength Bolted Construction: Install high-strength threaded fasteners in accordance with AISC "Specifications for Structural Joints using ASTM A325 or A490 Bolts". Bolts shall be installed with hardened washers under the element turned in tightening bolts to facilitate verification inspection.

- D. Welded Construction: Comply with AWS Code for procedures, appearance and quality of welds, and methods used in correcting welding work.
 - 1. Assemble and weld built-up sections by methods which will produce true alignment of axis without warp.
- E. Holes for Other Work: Provide holes required for securing other work to structural steel framing, and for passage of other work through steel framing members, as shown on final shop drawings.
 - 1. Cut, drill, or punch holes perpendicular to metal surfaces. Do not flame cut holes or enlarge holes by burning. Drill holes in bearing plates.
- F. Header Units: Provide header units to support tail joists at openings in floor or roof system unless otherwise indicated.

2.03 SHOP PAINTING

- A. General: Shop paint structural steel, except those members or portions of members to be embedded in concrete or mortar. Paint embedded steel which is partially exposed on exposed portions and initial 2" of embedded areas only.
- B. Do not paint surfaces which are to be welded or high-strength bolted with friction-type connections.
- C. Do not paint surfaces which are scheduled to receive sprayed-on fireproofing.
- D. Apply 2 coats of paint to surfaces which are inaccessible after assembly or erection. Change color of second coat to distinguish it from first.
- E. Painting: Provide a one-coat shop applied paint system complying with Steel Structures Painting Council (SSPC) Paint System Guide No. 7.00.

PART 3 - EXECUTION

3.01 ERECTION

- A. Field Assembly: Set structural frames accurately to lines and elevations indicated. Align and adjust various members forming part of complete frame or structure before permanently fastening. Clean bearing surfaces and other surfaces which will be in permanent contact before assembly. Perform necessary adjustments to compensate for discrepancies in elevations and alignment.
 - 1. Level and plumb individual members of structure within specified AISC tolerances.
 - 2. Splice members only where indicated and accepted on shop drawings.

- 3. Do not enlarge unfair holes in members by burning or by use of drift pins. Ream holes that must be enlarged to admit bolts.
- 4. Gas Cutting: Do not use gas cutting torches in field for correcting fabrication errors in structural framing unless acceptable to Architect/ Engineer. Finish gas-cut sections equal to a sheared appearance when permitted.
- 5. Touch-Up Painting: Immediately after erection, clean field welds, bolted connections, and abraded areas of shop paint. Apply paint to exposed areas using same material as used for shop painting. Apply by brush or spray to provide minimum dry film thickness of 1.5 mils.
- B. Anchors: Furnish bearing plates and other devices to be built into concrete and masonry construction.
 - 1. Provide unfinished threaded fasteners for anchor bolts unless otherwise noted.
 - 2. Refer to Division 3 sections for installation of anchors set in concrete.
 - 3. Refer to Division 4 sections for installation of anchors set in masonry.

3.02 QUALITY CONTROL

- A. A tension calibrator furnished by the erector will be required at the jobsite to be utilized in the tightening of slip-critical bolted joints.
- B. Owner will engage an independent testing and inspection agency to inspect high-strength bolted connections and welded connections and to perform tests and prepare test reports.
- C. Testing agency will conduct and interpret tests and state in each report whether test specimens comply with requirements and specifically state any deviations therefrom.
- D. Provide access for testing agency to places where structural steel work is being fabricated produced, or erected so that required inspection and testing can be accomplished.
- E. Testing agency may inspect structural steel at plant before shipment; however, Architect/ Engineer reserves right, at any time before final acceptance, to reject material not complying with specified requirements.
- F. Correct deficiencies in structural steel work which inspections and laboratory test reports have indicated to be not in compliance with requirements. Perform additional tests, at Contractor's expense, as may be necessary to re-confirm any non-compliance of original work, and as may be necessary to show compliance of corrected work.

END OF SECTION

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SECTION 05400 - LIGHT GAUGE METAL FRAMINGS

PART 1 - SCOPE

A. Work under this section includes light gage steel studs, framing members, joist, purlins and related accessories as indicated on Drawings and specified herein.

1.01 STANDARDS:

- A. Work shall meet the requirements of the following standards.
 - 1. American Iron and Steel Institute (A.I.S.I.) Design of Cold Formed Steel Structural Members, 1980
 - 2. American Welding Society (A.W.S.) D.1.3., 1981 Structural Welding Code Sheet Steel.
 - 3. American Society for Testing and Materials (A.S.T.M.)
 - 4. American Institute of Steel Construction (A.I.S.C.) Manual of Steel Construction, 8th Edition.
 - 5. All pertinent Federal, State and local codes.
- B. The most stringent requirements shall govern in conflicts between specified codes and standards.

1.02 SUBMITTALS:

- A. Prior to framing fabrication, submit formal fabrication and erect shop drawings for Architect's approval.
- B. Shop Drawings shall indicate:
 - 1. All member guages, spacings and sizes.
 - 2. Shop and field assembly details including cut and connections.
 - 3. Type and location of welds, bolts and fastening devices.

PART 2 - MATERIALS

A. All studs and/or joists and accessories shall be of the type, size, gauge and spacing shown on the drawings, and shall be manufactured by ClarkDietrich Building Systems or equal.

- B. All structural members shall be designed in accordance with American Iron and Steel Institute (AISI) "Specification for the Design of Cold-Formed Steel Structural Members," edition.
- C. All framing members shall be formed from corrosion-resistant steel, corresponding to the requirements of ASTM A446, with a minimum <u>yield strength of 40 ksi for SJ and CS-style</u> studs, 33 ksi for CR-runners. Unless indicated differently on drawing details.
- D. Fabrication:
 - 1. Framing components may be preassembled into panels prior to erecting. Prefabricated panels shall be square, with components attached in a manner as to prevent racking. Members shall be held positively in place until properly fastened.
- E. Prefabricated panels shall be square with components attached in a manner as to prevent racking and to minimize distortion while lifting.
- F. All framing components shall be cut squarely for attachment to perpendicular members, or, as required for an angular fit against abutting members.
- G. Axially loaded studs shall be installed in a manner which will assure that their ends are positioned against the inside of runner web prior to fastening.
- H. Insulation equal to that specified elsewhere shall be provided in all doubled jamb studs and doubled headers not accessible to insulation contractors.
- I. Fastening of components shall be with self-drilling screws or welding. Screws shall be of sufficient size to insure the strength of the connection. Wire tying of components shall not be permitted. All welds shall be touched up with a zinc-rich paint.

PART 3 - EXECUTION

- A. Inspection shall be for proper size to ensure members are not bent or in poor condition.
- B. Product Handling:
 - 1. Upon delivery, material shall be protected from rain and snow by impervious covering or shelter.
- C. Trusses shall be securely anchored to the supporting structure as shown on the drawings.

END OF SECTION

SECTION 05500 - MISCELLANEOUS METALS

PART I - SCOPE

A. This Section includes the furnishing and installation of all miscellaneous metal items required for the project as shown on the Drawings and specified herein.

PART 2 - COORDINATION

- A. Coordinate furnishing of items specified hereunder with work of other trades so that progress of related work is not delayed.
- B. Take field measurements at the job as necessary to insure fit.

PART 3 - MATERIALS

- A. Stock or manufacturer's standard items shall be as described under individual item specifications hereunder.
- B. Fabricated items, made especially for this project, shall meet general materials specifications as listed hereunder. Materials shall be of the type, class, temper, etc., which best suit intended uses.
 - 1. Steel shall conform to ASTM Specification A-7 or A-36 for structural steel. Architectural and miscellaneous steel not otherwise indicated or specified shall be mild steel.

Shop Drawings and Data: Show complete details and instructions for fabrication, assembly, and installation. Locate anchor bolts required for installation in other work.

Inserts and Anchorages: Furnish inserts and anchoring devices to be built into other work for installation of miscellaneous metal items.

Steel Plates, Shapes, Bars: ASTM A 36

Tubular Steel Items: Square and rectangular, ASTM A 501; pipe, ASTM A 120.

Cold-Rolled Steel Sheets: ASTM A 366.

Galvanized Steel Sheets: ASTM A 526, with ASTM A 525 G90 zinc coating.

Concrete Inserts: Malleable iron (ASTM A 47) or cast steel (ASTM A 27) inserts, with steel bolts, washers and shims; hot dip galvanized.

Shop Paint: FS TT-P-86, Type 2; or, SSPC-Paint 14. Apply to prepared steel surfaces at rate to provide a 2.0-mil dry film thickness.

Galvanizing: ASTM A 386 for assembled products; A 153 for iron and steel hardware.

Fabrication, General: Use materials of size and thickness shown. Shop-paint all items not specified to be galvanized after fabrication.

Curb Edge Bars: Fabricate of shapes as shown; miter corners and weld joints. Provide anchors 6" from ends of corners and 24" o.c.

Loose Bearing Plates: Provide for steel items bearing on masonry or concrete, as shown. Drill plates to receive anchor bolts.

Miscellaneous Framing and Supports: Provide as required to complete work and not included with structural steel framework.

Steel Pipe Railings: Fabricate to dimensions shown, with smooth bends and welded joints. Use 1-1/2" steel pipe unless otherwise shown.

Installation: Perform cutting, drilling, and fitting required for installation; set work accurately in location, alignment and elevation, measured from established lines and levels. Provide anchorage devices and fasteners where necessary for installation to other work.

PART 4 - SHOP PAINTING AND PROTECTIVE COATING

- A. All ferrous metal shall be properly cleaned and given one shop coat of red lead, zinc chromate, or other approved rust resisting paint. Anchors that are built into masonry or concrete shall be coated with asphalt paint unless specified to be galvanized. Where galvanized or zinc coated metal is required, it shall not be shop primed unless specifically called for, but all abraded places and welding shall be touched up with aluminum paint. No prime coat is required for non-ferrous metal.
- B. Where hot-dip galvanized or hot zinc coating is specified, it shall be done in accordance with the Standard Specifications of the American Hot Dip Galvanizers Association.

PART 5 - FASTENINGS

- A. Welding. Perform all welding in accordance with American Welding Society publication AWS D1.0, latest edition with current supplements and addenda.
 - 1. Welds shall be made only by operators experienced in performing the type work indicated.
 - 2. Welds normally exposed to view in the finished work shall be uniformly made and ground smooth.

- 3. Where welding is done in proximity to glass or finished surfaces, such surfaces shall be protected from damage due to weld sparks or spatter.
- B. Bolted Screwed, and Riveted Connections. In general, use bolts fro field connections only as directed. Provide washers under all heads and nuts bearing on wood. Draw all nuts tight and nick threads of permanent connections to prevent loosening. Use beveled washers where bearing is on sloped surfaces.
 - 1. Where screws must be used for permanent connection in ferrous metal, use flat head type, countersunk.
 - 2. Where rivets are used, they shall be machine driven, tight, heads centered, countersunk and finished flush and smooth.

PART 6 - MISCELLANEOUS ITEMS

- A. Anchoring Devices. Furnish all miscellaneous metal anchoring devices required to be built into concrete or masonry or welded to steel framing members for anchorage of collateral work which are not specified to be furnished under other sections of the Specifications. Items include, but are not necessarily limited to the following:
 - 1. Anchor bolts for miscellaneous anchorage built into concrete or masonry not furnished under work of structural steel shall be hex-head steel machine bolts of sizes shown in the details, shall conform to ASTM A354, and shall be furnished with nuts and plate washers of size to suit the particular application.
- B. Loose Lintels. Furnish all loose steel angle and/or plat lintels not furnished as part of structural steel under work of Section 05120 as required for support of masonry over openings. Members shall be of sizes shown, and, unless otherwise indicated, shall have minimum bearing at each end of 8".

End of Section

SECTION 06400 - PLASTIC LAMINATE CASEWORK AND COUNTERTOPS

PART 1 - DESCRIPTION

- A. Furnish and install plastic laminate casework and countertops as shown on the drawings and specified herein.
- B. Work included:
 - 1. Casework plastic laminate faced.
 - 2. Plastic laminate covered countertops for wood and laminate casework.
 - 3. Plastic laminate covered shelves.
 - 4. Standard hardware and accessories.
 - 5. Plastic laminate window stools throughout building at exterior windows as detailed. Clerestory windows above 12' AFF in PEMB exterior walls do not have window stools.
- C. Related work specified elsewhere:
 - 1. Rough carpentry: Section 6100
 - 2. Finish carpentry: Section 6200
 - 3. Gypsum Drywall: Section 9250
 - 4. Resilient base: Section 9650
 - 5. Mechanical work: Division 15
 - 6. Electrical work: Division 16
 - 7. Metal casework: Section 11600

PART 2 - QUALITY ASSURANCE

- A. Custom plastic laminate faced casework shall match in design, material, finish and detail the stock plastic laminated casework. The materials, workmanship and installation of all casework provided under this section shall be the responsibility of this contractor.
 - 1. The contractor providing the work described herein, may be a custom casework contractor with a casework manufacturer as a subcontractor/supplier; or a stock casework with a custom casework manufacturer as a subcontractor/supplier.
- B. Any casework manufacturers requesting approval shall provide to architect, all information and specifications of the products they wish to use in bidding, ten days prior to bid date. Approval will be contingent upon whether the products meet the required specifications.
- C. The architect reserves the right to disapprove any subcontracting fabricator proposed for this project. The casework contractor shall submit to the architect, prior to fabrication, a letter signed by a responsible officer of the fabricator indicating satisfactory evidence of having completed comparable work for the past five years on similar projects utilizing equipment, methods and workmanship meeting the standards specified in this section.
- D. If requested by the architect, manufacturers requesting approval shall submit full size production line samples of the following units at least ten days prior to bid opening.

- 1. One cabinet base unit, 36" wide with door and drawer, complete with laminate top to fit.
- E. Reference standards:
 - 1. Architectural Woodworking Institute (AWI) "Quality Standards".
 - 2. National Electrical Manufacturers Association (NEMA) "LD 1 thru LD3" High Pressure Decorative Laminates.
 - 3. Federal Specifications (FS) "LLL-H-00810: Building Board (Hardboard), Hard Pressed, Vegetable Fiber".
 - 4. American National Standard (ANSI) A208.1-79 "Mat-Formed Wood Particleboard".
 - 5. Commercial Standards (CS) "C.S. 35: Adhesives".

PART 3 - SUBMITTALS

- A. Certifications: Letter of subcontractors qualifications and experience within the past five years and references of work completed.
- B. Color Selection: Complete range of color, textures and patterns of the proposed plastic laminate manufacturer, based upon the preliminary color selections listed hereinafter, with architect's approval. Final approval shall be contingent upon providing colors, textures and patterns matching preliminary selections.
- C. Shop Drawings: Submit shop drawings of items specified herein. Indicate: plan views, elevations, sections and details of each item; location in the building of each item; conditions in relation to adjacent materials and construction; methods of assembling sections; location and installation requirement size(s); shape and thickness of materials, joints and notations of special features; sink locations; and drawings required to illustrate deviations from the contract requirements.
- D. Rough in drawings: submit separate utility rough in drawings which indicate points of connection to each utility involved. Reference dimensions from building components.

PART 4 - PRODUCTS DELIVERY, HANDLING AND STORAGE

- A. Schedule casework for fabrication and delivery to avoid delay in work progress. Delivery to job site shall not be earlier than one month before casework can be installed. Verify delivery date with general trades contractor.
- B. Receive, unload, check, store, protect and distribute materials specified in this section.
- C. Store materials to maintain the moisture content of the wood members between 6% and 15%. Store in areas or rooms with temperatures at 70°F \pm 10°F.
- D. Store under cover in a ventilated building not exposed to extreme temperature and humidity changes. Do not store or install casework until concrete, masonry and plaster work is dry.

PART 5 - JOB CONDITIONS

A. Prior to fabrications of items of casework which are dependent upon building dimensions,

take accurate field measurements of location of walls, drop soffits, columns, piers and other applicable building elements. Major discrepancies between dimensions given on the drawings and field dimensions shall be brought to the attention of the general trades contractor. Compensate for minor dimensional changes so that fabricated items can be delivered to the job, and can be scribed to fit properly.

B. In no instance shall any casework be stored or installed in any area unless the area is broom clean, closed in and possessing a relative humidity below 50% at 70°F.

PART 6 - WARRANTY

A. Warranty in writing that defects due to use of improper materials or workmanship in casework provided under this contract for the period of one year from the date of substantial completion of the work, shall be rectified promptly by the casework contractor at his own expense upon notification of condition.

PART 7 - GENERAL

- A. Casework, both stock and custom shall be plastic laminate construction consisting of high pressure decorative laminate bonded to 3/4" thick particle board.
 - 1. Fabrication shall comply with applicable requirements for "Custom grade" as indicated in Section 400 of the AWI architectural woodwork quality standards and guide specifications.
- B. Cabinet units shall be assembled at the mill, insofar as access openings to installation location will permit. Where items must be built into sections, design the units so they can be assembled at the site into one integral item, with exposed joints flush, tight and uniform. Similar adjoining doors and drawers shall be in alignment and each door and drawer shall operate smoothly, without bind or excessive play.
- C. Casework units shall be complete with bases, shelves, counter and work tops, finish and operating hardware, drawer accessories and miscellaneous accessories as indicated on the drawings and specified herein.
- D. Coordination work:
 - 1. Division 9: Provide physical openings for recessed casework.
 - 2. Section 6100: Provide grounds and blocking necessary for attachment and support of wallmounted casework.
 - 3. Plumbing Prime Contractor: provide lay-in sinks, faucets and fittings; templates for cutouts for installation; provide supply and waste lines including traps to rough in points based on information supplied by the casework contractor; and provide final connections.
 - a. Division 15: Provide stainless steel sinks with integral with tops and backsplashes, include tailpieces, drains and strainers.

- 4. Electrical prime contractor: provide electrical fixtures and equipment noted on drawings including related boxes, conduit and conductors. Provide electrical components complete, terminating through the back of the casework unit either with a junction box or a 2" conduit stub. Allow conductors to protrude 8" to permit final connection by Division 16.
- 5. Division 16: Locate rough-ins based on information given on casework rough-in drawings and be responsible for work necessary to make final connections.
- 6. Division 9650: Apply resilient base to casework after casework has been installed.
- 7. Division 5500: Provide steel support braces.
- E. Definitions shall conform to the following:
 - 1. Exposed portions are those visible from a normal point of view when doors and drawers are closed. Interiors of open cabinets, and open shelving are considered exposed.
 - 2. Semi-exposed portions are those areas not considered exposed, but which are visible from a normal point of view when solid doors and drawers are open. Backs of hinged doors, drawer parts except the exposed exterior front, and shelving in the storage areas are considered semiexposed.
 - 3. Concealed portions include sleepers, web frames, dust panels and other surfaces not visible after installation.

PART 8 - MATERIALS

- A. Particle board: 45 lbs. Minimum density and of balance construction, with moisture content less than 8%. Particle board shall conform to ANSI A208.1 and meet or exceed CS-236-66, FS LLL-B-800A and ASTM D1037-78.
 - 1. Surfaces shall be smooth with all chips, shavings or flakes well scoured so that there shall be no visible telegraphing of the core face through the plastic laminate.
 - 2. Square and rectangular cutouts shall have radiused corners not less than 2".
 - 3. At cut edges, exposed or not and where cutouts occur, the edges shall be completely sealed to prevent moisture absorption. Cutouts for pipes shall be round.
 - 4. Meet the following performance requirements: Submit compliance date from the manufacturer prior to fabrication.
 - a. Screw holding face: 371 lbs.
 - b. Modulus of rupture: 2400 psi
 - c. Modulus of elasticity: 450,000 psi
 - d. Internal bond: 90 psi
 - e. Surface hardware: 90 psi
- B. Edging: Flat edge design for cabinet body in color matched laminate or PVC. Color as

selected by architect.

- C. Plastic Laminate: High pressure decorative laminate surfacing material meeting the minimum NEMA Standards for abrasion resistance, heat resistance, stain resistance, moisture resistance, dimensional stability and general rules for fabrication and installation.
 - 1. Plastic laminate materials shall be as selected by the Architect from <u>full</u> product line of national manufacturers such as Formica, Wilsonart, Pionite, Nevamar and Arborite.
 - 2. Exposed horizontal work surfaces: NEMA GP50, PF (Post-forming) satin surface.
 - 3. Exposed vertical work surfaces: NEMA GP 28 laminate.
 - 4. Semiexposed surfaces: 10 mil polyester laminate in conformance to ASTM D1300, factory bonded at 200 psi at 300°F, minimum. Color shall be manufacturers white.
 - 5. Backing sheet: NEMA BK20 and shall be used where laminate covered work is not restrained from warping or twisting by the method of attachment or by supports. Minimum standard of AWI Custom work shall apply.
 - 6. Bonding adhesive: Water resistant type and as recommended by the approved plastic laminate manufacturer. Plastic laminate shall be applied to the core in the shop, using commercial methods, application and presses.
 - 7. Sealant used for sealing particle board or plywood edges shall be HYBOND 80 by Pierce Stevens Corporation.
- D. Assembly adhesives used in assembly, installation and other applications, shall be one of the following:
 - 1. HYBOND 80
 - 2. HYBOND WHITE
 - 3. CANPLAST 100
- E. Provide hardware as follows: This is not intended to be a complete listing, but as a guide to establish quality:
 - 1. Hinges shall be cast steel cup and hinge concealed hinges #75M5550 by BLUM
 - a. Hinges shall have independent three way adjustment of doors.
 - b. One pair of hinges per door of 30" or less, one and one half pair of hinges per door of 48" and one hinge for every 12" of door over 48".
 - c. Each hinge shall be removable by means of a clip mechanism lever attached to the

hinge.

- d. Hinges shall be mounted into corresponding hinge plates.
- e. Hinges shall have 125° free movement of swing and be self closing within two inches of close.
- f. Hinges shall have a lifetime warranty against defects from workmanship and materials.
- g. Hinges shall be installed into door panels by means of a pre-drilled hole and press fitted into panel substrate.
- 2. Pulls for all doors and drawer fronts shall be manufacturers standard bent wire pull, brushed chrome finish, three inch centers. Nomenclature for this ABP865-26D by AMEROCK.
- 3. Drawer slides shall be side mounted, bottom supported, 4 point suspension slides with nylon roller bearing and epoxy coating.
- 4. All file drawers shall have either Pendaflex or file followers.
- 5. All shelf clips shall be BLUM nylon covered steel pin (5mm) that will mount into predrilled end panels for a support of at least 250 lbs.
- 6. Locks, noted on drawings, shall be cam tumbler by NATIONAL LOCK.
- 7. Clothes rods and mounting flanges shall be Knape-Voght #770 and #734.
- 8. Optional sliding doors are mounted on steel tracks and use ball bearing sheaves mounted in the doors.
- 9. Grommets shall be spring loaded closure type in assorted sizes.

PART 9 - CONSTRUCTION

- A. All cabinets shall be of 3/4" thick MCP by Domtar, finished ends and dowel pinned to tops, bottoms or backs, shall be laminated with plastic laminate and edged with matching PVC.
 - 1. End panels shall consist of a single panel of MCP drilled and dowel pinned to tops, bottoms or braces by way of fluted hardwood dowel pins nested in white glue.

- 2. All cabinet boxes shall be case clamped for a minimum of seven minutes in a Holzer case clamp to insure squareness.
- 3. End panels shall be drilled for shelves, bottoms, tops and braces using the 32mm drilling system. All components will be drilled in corresponding patterns.
- 4. End panels shall be rabbited at the rear for acceptance of 3/8" thick MCP back. The back will be mounted using mechanical fasteners. The back shall be removable.
- 5. End panels shall have integral toe kicks and shall have a front of 3/4" MCP mechanically fastened to the end panels.
- B. Doors shall be of 11/16" thick laminated panel products with the front face laminated in the architects color selection. The semi-exposed side shall be covered by white HPL plastic laminate. The edges shall be covered by PVC or self-edged.
- C. Drawers shall be constructed of 1/2" thick MCP, rabbited, glued and mechanically fastened for a strong bond. Bottoms shall be of 3/8" thick MCP mechanically fastened to the drawer box frame. Top edges shall be covered in white PVC edging. Drawer fronts are same construction as doors. Drawer fronts shall be removable from drawer box for easy alignment. Drawers shall have epoxy coated, nylon roller bearing, side mounted, bottom supported slides by BLUM.
- D. Shelves shall be of 3/4" thick MCP and edged with matching PVC edging. Shelves shall not be constructed over 42" in length.
- E. Braces shall be of 3/4" thick MCP and shall span the width of the cabinet box. Braces shall be edged on visible sides with PVC edging. On sink or range base cabinets the front brace shall be mounted vertically and shall be laminated to match the cabinet exterior.
- F. Backs shall be of 3/8" thick MCP and be rabbited in and mechanically fastened to the end panels.
- G. Wall cabinets shall be of 3/4" thick MCP and shall be dowel pinned in the same manner as the bases. Wall backs are 3/8" thick rabbited and mechanically fastened to end panels.
- H. Finished backs shall be of 3/4" MCP laminated with plastic laminate on face and edged with PVC.
- I. Top supports shall be of 3/4" MCP laminated on both sides and edged with PVC or plastic

laminate.

PART 10 - COUNTERTOPS

- A. Countertops and backsplash shall be custom made with square, self-edge and shall be constructed of 3/4" thick medium density fiberboard (MDF) or 45# density particleboard (CS 236-66: Type 1, Grade B, Class 2) covered on all exposed surfaces with horizontal grade 10/HGS, .050" thickness, high pressure laminate as manufactured by a nationally known laminate company.
 - 1. Colors and patterns of plastic laminate shall be as selected by the Architect from full product line of national manufacturers such as Formica, Wilsonart, Pionite, Nevamar and Arborite.
 - 2. Provide cutouts properly sized and located in tops for sinks and rims by others.
 - 3. Provide end splash, flush with all edges of countertop, where countertop abuts wall surfaces.

PART 11 - BRACING

Where countertops have no casework below for support, bracing or "cleats" shall be constructed 12" x 12" x length and covered by GP 28 plastic laminate on all exposed sides. These cleats shall be mounted at walls with mechanical fasteners to support the weight of the countertop.

PART 12 - COORDINATION

- B. Coordinate work of this section with related work of other sections as necessary to obtain proper installation of all items.
- C. Verify site dimensions of cabinet location in buildings prior to fabrication.
- D. Do not install casework until all concrete, masonry and plaster work is dry.

PART 13 - INSTALLATION

- A. Installation shall consist of assembling to form complete units, placing, leveling, scribing, trimming and anchoring.
 - 1. Filler between wall and casework shall not exceed 1" unless noted otherwise and shall be recessed 1/16" + from the face of casework.

- 2. Plastic-laminate covered ceiling enclosures shall be flush with the face of the doors and 1/8" proud on the sides of exposed ends or backs.
- B. Fasten items to building construction as detailed or as otherwise required to provide a secure, permanent installation.
- C. Where fastening spacings or sizes are not shown, use spacings and sizes of bolts, screws, etc., which will develop the full strength of the members being fastened. Thus failure due to over stress must occur in the members before occurring in the fastenings.
 - 1. Fastening to concrete shall be by anchor bolts embedded in masonry or by self drilling masonry anchor.
 - 2. Fastening to masonry shall be of similar manner.
 - 3. Fastening to plaster or drywall construction shall be into wood studs or blocking placed there early in the construction. Toggle bolts may be used only in such cases where no blocking can be found, but fasteners must still penetrate solid wall supports for a secure installation.

PART 14 - PROTECTION

Upon installation of casework and countertops, all installed materials shall be covered with appropriate protection from further construction. The General Contractor will be responsible for repairing or replacing any product damaged by subsequent construction and finish work, with no additional cost to the Owner.

End of Section

SECTION 07200 - BUILDING INSULATION

PART 1 - SCOPE

A. This Section includes all labor, materials, equipment and related items required to complete the work of building insulation as shown on the drawings and as specified.

PART 2 - SUBMITTALS

- A. Certificates of Compliance with applicable Federal Specifications shall be submitted to the architect for approval prior to delivery of any building insulation to the project. "R" values of insulation proposed to be furnished shall be included in certifications.
- B. Samples in duplicate of each type of building insulation shall be submitted to the architect for approval if requested.

PART 3 - MATERIALS

- A. Batt insulation shall be semi-rigid, spun glass fiber blankets, R-19 or refer to drawing wall sections in retrofit conditions.
 - Non-exposed blankets shall be enclosed on one side with strong asphalted paper vapor barrier. Blankets shall be as wide as required to fit into stud, by longest available lengths.
 - Exposed blankets for installation in exterior wall space shall be nominal 6" thick, Fiberglass batt faced (FSK-25)(Class A), having minimum material thermal resistance (R) of 19 or refer to drawing wall sections in retrofit conditions..
- B. Sound attenuation blankets for areas where noted shall comply with requirements of ASTM C665-84, Type I. Same shall be 3" "Thermofiber", as manufactured by United States Gypsum; 3" "Thermal-Acoustical Batts", as manufactured by Johns-Manville; 3¹/₂" "Noise Barrier Batt Insulation", as manufactured by Owens/Corning; or an approved equal.
C. Retrofit insulation at existing PEMB walls and roof. Refer to wall sections for the specifics of existing vinyl covered insulation repair and replacement of wet or damaged insulation and vinyl covering. In Manufacturing and Office area, provide additional insulation value required with new vinyl cover at walls and roofs. Provide a system to repair and replace existing insulation, and as indicated on plans and section, provide additional vinyl covered insulation for code compliant wall and roof insulating value in heated and cooled occupied areas. Warehouse area is heated only with overhead fans and does not require additional insulation, repair only in warehouse. Systems include retrofit hangers (stick pins), and banding system to reface and add insulation for a complete system.

Manufacturers:

- 1. Simple Saver System by Thermal Design (retrofit system).
- 2. Steel Building Insulation (retrofit system).
- 3. Or Equal performing system

PART 4 - INSTALLATION

- A. Batt insulation shall be installed in stud, in strict accordance with manufacturer's installation instructions, securely fastened to framing members by nailing or stapling, with paper vapor barriers to inside face of stud. Insulation shall have full coverage in spaces involved, with tightly fitted butt joints where necessary and free from voids.
 - 1. Install insulation to the outside of any water piping occurring in exterior walls. In these cases, no insulation shall occur between water piping and wall finish.
- B. Install Vapor Retarder (DuPont Tyvek[®] stucco wrap water-resistant barrier or approved equal) on the outside face of the exterior gypsum sheathing.

End of Section

SECTION 07900 - JOINT SEALERS

PART 1 - SCOPE

- A. This Section includes all labor, materials, equipment, and related items required for the work of caulking as shown on the Drawings and as specified herein. Work under this Section includes but is not necessarily restricted to the following:
 - 1. Caulking of exterior or interior expansion or control joints in concrete or masonry.
 - 2. Other joints, exterior or interior, in the building construction shown, specified, or required to be caulked.

PART 2 - SUBMITTAL

- A. Contractor shall submit to the Architect, in duplicate, for approval the following items prior to furnishing any materials at the job site.
 - 1. Sample cards of all exposed caulking and sealant for color approval. Unless otherwise directed, apply samples in minimum 3" runs on cards.
 - 2. One lineal foot of each type of backer material proposed.

PART 3 - PRODUCT HANDLING

- A. Deliver caulking, and related accessories to the job site in factory sealed, unopened containers bearing manufacturer's name and product designation.
- B. Store materials in unopened containers, following manufacturer's recommendations for storage temperature and shelf life.
- C. Follow manufacturer's recommendation for handling products containing toxic substances. Keep flammable materials away from heat, sparks, and open flames. Use recommended solvents and cleaning agents for cleaning tools and equipment.

PART 4 - ENVIRONMENTAL CONDITIONS

A. Schedule caulking operations so that working joints are most likely to be normal size. Apply materials within manufacturer's recommended surface and ambient temperature range.

PART 5 - PROTECTION

A. Use masking tape where practicable to control lap of materials onto adjacent surfaces or to facilitate tooling. Remove tape immediately after caulking operation.

PART 6 - MATERIALS

- A. General. All caulking, primers, and accessories shall be non-staining to adjacent exposed materials. Products having similar application and usage shall be of the same manufacturer and type. Unless otherwise specified, colors shall be selected from approved manufacturer's standard color sections. Use gun consistency compounds unless otherwise required by job conditions.
- B. Exterior caulking shall be a one or two-component polysulfide base, elastic, synthetic rubber compound, conforming to Federal Spec. TT-S-00230, and shall be "Sonolastic" as manufactured by the Sonneborn Building Products, Inc., "Synthacalk" as manufactured by the Pecora Chemical Corp., or "Rubber Calk 500" as manufactured by the Products Research & Chemical Corp or an approved equal.
 - 1. Colors shall be from manufacturer's standards as selected by the Architect.
- C. Interior caulking for general use shall be a one-component acrylic latex compound, and shall be "Sonolac" as manufactured by the Sonneborn Building Products, Inc. "AC-20" as manufactured by the Pecora Chemical Corp., or "Latex Caulk" as manufactured by DAP, Inc.
- D. Primers shall be as manufactured and recommended for each substrate by the manufacturer of each caulking compound used in the work.
- E. Backer materials shall be as recommended for and compatible with each caulking used, and shall be as follows unless otherwise required to meet specific job conditions.
 - 1. Backer rod for use in all joints requiring backer for caulking shall be a soft, closed cell polyethylene foam meeting requirements of AASHO Specifications M153-54, Type I and III, and shall be as manufactured by the Dow Corning Corp., Sonneborn Building Products, Inc., or Williams Products, Inc.
- F. Release material, where required, shall be polyethylene film.

PART 7 - MIXING

- A. Job mix multi-component sealants with suitable power operated equipment, following specific directions of sealant manufacturer.
- B. Base and accelerator components of multi-part sealants shall have batch control numbers clearly indicated on containers. Control numbers for mixed components shall be identical.

PART 8 - CONDITION OF SURFACES

A. Inspect all surfaces to receive caulking materials, and report all defects. Starting work implies acceptance of surfaces as satisfactory. Verify that joints and spaces to be caulked are of proper width.

- B. Concrete surfaces shall be thoroughly cured.
- C. Apply no caulking materials in contact with surfaces contaminated with oil, grease, bituminous materials, form release agents, bond breakers, deleterious curing compounds, water repellents, and other special surface treatments. Aluminum surfaces shall be free of lacquer. Costs incurred by removal of such contaminants shall be borne by the trades responsible for their presence.

PART 9 - PREPARATION

- A. Thoroughly clean all joints, removing all foreign matter such as dirt, dust, moisture, frost, rust, paint, lacquer, and protective coatings. Blow all joints free of loose particles.
- B. Use no cleaning solvents which leave residue. Wipe joints free of solvent using clean, dry white cloths or white lint less paper. Do not permit solvent to air dry.
- C. Follow manufacturer's directions for products and surfaces.

PART 10 - INSTALLATION

- A. Unless otherwise required by these specifications, install materials in strict accordance with manufacturer's specifications and recommendations, using approved equipment.
- B. Usage of various materials shall be as specified under Article 6 above.
- C. Prime surfaces as recommended by the manufacturer's immediately prior to caulking or sealing. Make preliminary tests to ensure that primers will not stain exposed materials or deteriorate backer materials.
- D. Unless otherwise required by caulking manufacturer's specifications and recommendations, use backer material to control caulking and sealant depth as follows (depths measured at bond face).
 - 1. Polysulfide and Polyurethane Sealants. For joints up to 1/2" wide and less, make depth equal to width but not less than 1/4". Joints over 1/2" wide shall be 3/8" deep.
 - 2. Acrylic Sealant. For joints 1/2" wide and less, make depth equal to width but not less than 1/4". Joints over 1/2" wide shall be 3/8" deep.
 - 3. Do not twist or stretch preformed backer materials during installation.
- E. At joints subject to movement, where required by nature of backer material used or where sealant contacts back of joint, use release material between backer material or back or joint and sealer to confine adhesion to surfaces of materials being joined. Follow manufacturer's recommendation exactly.

F. Neatly tool joints to slightly concave surface using tooling agent recommended by sealant manufacturers. Repair any air pockets exposed by tooling. Tool so as to compress material and improve adhesion to surfaces joined.

PART 11 - PATCHING

A. Patch or replace defective or damaged sealants as directed by the Architect. Be responsible for damage to adjacent surfaces caused by caulking and sealing operations.

PART 12 - CLEANING

A. Clean adjacent surfaces soiled by caulking and sealing operations. Remove wet material before it "sets". Follow manufacturer's recommendations for cleaning procedures. Cleaning agents shall not stain or be injurious to exposed surfaces nor shall they be potentially dangerous to glass and metal surfaces due to wash-off by rain.

END OF SECTION

SECTION 08100 - METAL DOORS AND FRAMES

PART 1 - RELATED DOCUMENTS

A. General provisions of Contract, General and Special Conditions, and General Requirements apply to this Section.

PART 2 - DESCRIPTION OF WORK

- A. Provide labor, materials, equipment, and services necessary for proper and complete installation of all hollow metal work.
- B. Include all view windows and side lights indicated on Drawings.
- C. Work Specified in Other Sections.
 - 1. Finish Hardware is specified in another Division 8 Section.

PART 3 - LABEL CONSTRUCTION

Where Label Construction is indicated in Door and Frame Schedule, materials and construction of doors and frames shall be in accordance with and bear indicated resistive rating label of Underwriters' Laboratories, Inc.

PART 4 - SUBMITTALS

Submit Shop Drawings for all work, indicating materials, uses, gauges, details of construction, connections to other work, fastenings, and anchors, to Architect for his review. Do not start fabrication until these Drawings are approved.

PART 5 - MATERIALS

- A. Manufacturers offering products complying with requirements include: Steelcraft Mfg. Co.
 Republic Steel Corporation Metal Products Inc (MPI) De La Fontaine
- B. Materials used shall be of best quality of their respective kinds.
- C. Steel in general shall be cold rolled stretcher level, prime quality steel, of U.S. Standard gauge as specified under the various headings.
- D. Doors, frames and framed openings exposed to the exterior shall be fabricated of zinc coated steel in the gauges scheduled. The steel shall be hot dipped so as to provide a ductile coating, tightly adherent to the base steel. The zinc coating shall be an A60 coating in accordance with ASTM specification A525 (.6 oz. of zinc per sq. ft. of steel total coverage.)

PART 6 - HOLLOW METAL STEEL DOORS, POLYURETHANE CORE

- A. Physical Properties:"R" Factor: 11.1"U" Factor: .09Compression Strength: 3600 P.S.F.
- B. Doors shall be equal to those manufactured by The Steelcraft Manufacturing Company, Cincinnati, Ohio, and designated as: LF-18 (1-3/4", 18 gauge steel)
- C. Doors shall be fabricated of:
 - 1. Cold rolled steel, interior.
 - 2. Galvanized steel with a zinc coating of .6 ozs. per square foot total, exterior.
- D. Door shall be flush with edge seams filled and ground smooth.
- E. Doors shall have 1/8" bevel in 2" on hinge and ground smooth.
- F. Doors shall have vertical mechanical interlocking seams on hinge and lock edges.
- G. Doors shall be provided with top and bottom inverted 14 gage steel channels spot welded within the door.
- H. Doors shall be mortised and adequately reinforced for all hardware.
 - 1. Mortised hardware reinforcements shall be drilled and tapped at the factory.
 - 2. Surface applied hardware shall be field drilled by others.
- I. Doors shall be reinforced internally with a 14 gage steel reinforcement for surface closers when specified.
- J. Out swinging exterior doors shall be provided with top caps for protection against weather and with a polyurethane core.
- K. Doors shall be phosphatized and receive one coat of baked on prime paint.

PART 7 - FRAMES

- A. Fabricate frames of 16 ga. steel. Manufacturers offering products complying with the requirements include: Steelcraft Mfg. Co. Republic Steel Corp. Fenestra, Inc.
- B. All frames shall have welded and mitered corners, equivalent to Steelcraft Type D-16. (Issue A).

- C. Frames in stud walls can be KD frames.
- D. Provide suitable anchors for jambs as required by wall construction. Provide a minimum of six (6) jamb anchors and two (2) base anchors per frame. Provide anchors as required for labeled frames.
- E. Reinforcing channels, where called for, shall be 12 gauge reinforcing channel in head.

PART 8 - HARDWARE REINFORCEMENTS

- A. Accurately mortise, reinforce, drill, and tap at factory all work to receive hardware, except do drilling and tapping for door checks and brackets at building.
- B. Reinforcements shall be of ample size and thickness to stiffen work against strain of service required. Reinforcements for locks and escutcheons shall be box type with spring lead contacts for lock cases.
- C. Provide cover boxes in back of all hardware cutouts in combination type frames.

PART 9 - FINISH

- A. All steel hollow metal work shall be phosphatized and receive one coat baked on prime coat.
- B. Each coat shall be baked on and sanded smooth.

PART 10 - INSTALLATION

- A. Set frames in their proper locations, plumb and true and securely braced in position.
- B. Receive, store and protect and be responsible for all doors to be installed hereunder. Report immediately to Contractor shortages, damage, improper preparation, defective finishes and warped doors. Do not install any material not perfect in every respect.
- C. Inspect openings and frames to receive doors. Report damage or discrepancy affecting proper installation of units to Contractor, and have corrective work done in a suitable and satisfactory manner.
- D. Install doors in openings as indicated on Drawings in conformance with shop drawings and hardware schedule. Install doors so they hang plumb and true, with proper clearances using items of hardware scheduled for openings.
- E. Accurately set all frames and thoroughly and rigidly anchor and fasten in place in building construction. Weld drywall anchors to frames.
- F. Check frames before and after walls are constructed to see that they are properly erected.

End of Section

SECTION 08211 - FLUSH WOOD DOORS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including the General and supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.02 SUMMARY

- A. This Section includes the following:
 - 1. Solid core doors with wood veneer faces.
 - 2. Factory fitting flush wood doors to frames and factory matching for hardware.
 - 3. Glazing stops and preparation of flush doors to receive glazing; glazing specified elsewhere.
- B. Related Sections: The following Sections contain requirements that relate to this Section:
 - 1. Architectural Woodwork: Division 6.
 - 2. Metal Door Frames: Elsewhere in Division 8.
 - 3. Door Hardware: Elsewhere in Division 8.
 - 4. Glass and Glazing: Elsewhere in Division 8.
 - 5. Field Finishing of Wood Doors: Section 09900 Painting.

1.03 SUBMITTALS

- A. General: Submit each item in this Article according to the Conditions of the Contract and Division 1 Specification Sections.
- B. Product data for each type of door, including details of core and edge construction, trim for openings and louvers, and factory-finishing specifications.
- C. Shop drawings indicating location and size of each door, elevation of each kind of door, details of construction, location and extent of hardware blocking, fire ratings, requirements for veneer matching and factory finishing and other pertinent data.
 - 1. For factory-machined doors, indicate dimensions and locations of cutouts for locksets and other cutouts adjacent to light and louver openings.
- D. Samples for verification in the form and size indicated below:
 - 1. Corner sections of doors approximately 12 inches (300 mm) square with door faces and edging representing the typical range of color and grain for each species of veneer and solid lumber required.
 - 2. Louvers consisting of blade and frame, 6 inches (150 mm) long, for each material and finish specified.
 - 3. Frames for light openings, 6 inches (150 mm) long, for each materials, type, and finish required.

1.04 QUALITY ASSURANCE

- A. Quality Standard: Comply with the following standard:
 - 1. AWI Quality Standard: "Architectural Woodwork Quality Standards: of the Architectural Woodwork Institute for grade of door, core, construction, finish, and other requirements.
- B. Fire-Rated Wood Doors: Provide wood doors that comply with NFPA 80; are identical in materials and construction to units tested in door and frame assemblies per ASTM E 152; and are labeled and listed by UL, Warnock Hersey, or another testing and inspection agency acceptable to authorities having jurisdiction.
 - 1. Oversized, Fire-Rated Wood Doors: For door assemblies exceeding sizes of tested assemblies, provide manufacturer's certificate stating that doors conform to all standard construction requirements of tested and labeled fire-door assemblies except for size.
 - 2. Temperature Rise Rating: At stairwell enclosures, provide doors that have a temperature rise rating of 450 deg F (250 deg C) maximum in 30 minutes of fire exposure.
- C. Single-Source Responsibility: Obtain doors from one source and by a single manufacturer.

1.05 DELIVERY, STORAGE, AND HANDLING

- A. Protect doors during transit, storage, and handling to prevent damage, soiling, and deterioration. Comply with requirements of referenced standard and manufacturer's instructions.
- B. Identify each door with individual opening numbers as designated on shop drawings, using temporary, removable, or concealed markings.

1.06 PROJECT CONDITIONS

- A. Conditioning: Do not deliver or install doors until conditions for temperature and relative humidity have been stabilized and will be maintained in storage and installation areas during the remainder of the construction period to comply with the following requirements applicable to Project's geographical location:
 - 1. AWI quality standard Section 100-S-11 "Relative Humidity and Moisture Content."

1.07 WARRANTY

A. General Warranty: Door manufacturer's 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.

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- B. Door Manufacturer's Warranty: Submit written agreement on door manufacturer's standard form signed by manufacturer, Installer, and Contractor, agreeing to repair or replace defective doors that have warped (bow, cup, or twist) more than 1/4 inch (6.35 mm) in a 42-by-84-inch (1067-by-2134-mm) section or that show telegraphing of core construction in face veneers exceeding 0.01 inch in a 3-inch (0.25 mm in a 75-mm) span, or do not conform to tolerance limitations of referenced quality standards.
 - 1. Warranty shall be in effect during the following period of time after date of Substantial Completion.
 - a. Solid Core Interior Doors: Life of installation.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

- A. Manufacturer: Subject to compliance with requirements, provide doors by one of the following:
 - 1. Solid Core Doors:
 - a. Algoma Hardwoods, Inc.
 - b. Eggers Industries, Architectural Door Division
 - c. Fenestra Corporation
 - d. Graham Manufacturing Corp.
 - e. Mohawk Flush Doors, Inc.
 - f. V-T Industries, Inc.
 - g. Weyerhauser Co.

2.02 INTERIOR FLUSH WOOD DOORS

- A. Solid Core Doors for Transparent Finish: Comply with the following requirements:
 - 1. Faces: See Finish Schedule
 - 2. Grade: Premium
 - 3. Construction: 5 or 7 plies
 - 4. Core: Particleboard core
 - 5. Bonding: Stiles and rails bonded to core, then entire unit abrasive planed before veneering.
- B. Fire-Rated Solid Core Doors: Comply with the following requirements:
 - 1. Faces and Grade: Provide faces and grade to match non-fire-rated doors in same area of building, unless otherwise indicated.
 - 2. Construction: Manufacturer's standard core construction as required to provide fire-resistance rating indicated.

- 3. Blocking: Provide composite blocking designed to maintain fire resistance of door but with improved screw-holding capability of same thickness as core and with minimum dimensions as follows:
 - a. 5-inch (125-mm) top rail blocking
 - b. 5-inch (125-mm) bottom rail blocking
 - c. 5-by-18-inch (125-by-450-mm) lock blocks
 - d. 5-inch (125-mm) midrail blocking.
- 4. Edge Construction: Provide manufacturer's standard laminated-edge construction for improved screw-holding capability and split resistance as compared to edges composed of a single layer of treated lumber.
- 5. Pairs: Provide fire-rated pairs with fire-retardant stiles that are labeled and listed for kinds of applications indicated without formed-steel edges and astragals.

2.03 LIGHT FRAMES

A. Wood-Veneered Beads for Light Openings in Fire Doors.

2.04 FABRICATION

- A. Fabricate flush wood doors to comply with following requirements:
 - 1. In sizes indicated for job-site fitting:
 - a. Comply with clearance requirements of referenced quality standard for fitting. Comply with requirements of NFPA 80 for fire-resistance-rated doors.
 - b. Coordinate measurements of hardware mortises in metal frames to verify dimensions and alignment before proceeding with factory machining.
 - c. Metal Astragals: Pre-matching astragals and formed-steel edges for hardware for pairs of fire-rated doors.
- B. Openings: Cut and trim openings through doors to comply with applicable requirements of referenced standards for kind(s) of door(s) required.
 - 1. Light Openings: Trim openings with moldings of material and profile indicated.

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Examine installed door frames prior to hanging door:
 - 1. Verify that frames comply with indicated requirements for type, size, location, and swing characteristics and have been installed with plumb jambs and level heads.
 - 2. Reject doors with defects.
- B. Do not proceed with installation until unsatisfactory conditions have been corrected.

3.02 INSTALLATION

- A. Hardware: For installation see Division 8 Section "Finish Hardware."
- B. Manufacturer's Instructions: Install wood doors to comply with manufacturer's instructions and referenced quality standard and as indicated.
 - 1. Install fire-rated doors in corresponding fire-rated frames according to requirements of NFPA 80.
- C. Job-Fit Doors: Align and fit doors in frames with uniform clearances and bevels as indicated below; do not trim stiles and rails in excess of limits set by manufacturer or permitted with fire-rated doors. Machine doors for hardware. Seal cut surfaces after fitting and machining.
 - 1. Fitting Clearances for Non-Fire-Rated Doors: Provide 1/8 inch (3.2 mm) at jambs and heads, 1/16 inch (1.6 mm) per leaf at meeting stiles for pairs of doors, and 1/8 inch (3.2 mm) from bottom of door to top of decorative floor finish or covering. Where threshold is shown or scheduled, provide 1/4-inch (6.4 mm) clearance from bottom of door to top of threshold.
 - 2. Fitting Clearances for Fire-Rated Doors: Comply with NFPA 80.
 - 3. Bevel non-fire-rated doors 1/8 inch in 2 inches (3-1/2 degrees) at lock and hinge edges.
 - 4. Bevel fire-rated doors 1/8 inch in 2 inches (3-1/2 degrees) on lock edge; trim stiles and rails only to extent permitted by labeling agency.
- D. Field-Finished Doors: Refer to Division 9, Section 09900 Painting, for finishing requirements.

3.03 ADJUSTING AND PROTECTION

- A. Operation: Rehang or replace doors damaged during installation.
- B. Finished Doors: Refinish or replace doors damaged during installation.
- C. Protect doors as recommended by door manufacturer to ensure that wood doors will be without damage or deterioration at the time of Substantial Completion.

End of Section

SECTION 08361 - SECTIONAL INSULATED OVERHEAD DOORS

PART 1 - GENERAL

- 1.01 Related Documents
 - A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division-1 Specification sections, apply to work of this section.
- 1.02 Description of Work
 - A. Extent of sectional insulated overhead doors are shown on drawings.
 - 1. Furnish and install motor operated sectional steel insulated overhead doors.
- 1.03 Quality Assurance
 - A. Provide each sectional insulated overhead door as a complete unit produced by one manufacturer, sections, brackets, guides, tracks, counterbalance mechanisms, hardware, weatherstripping and installation accessories, to suit openings and head room allowable.
 - B. Provide setting drawings, templates, and directions for installation of anchorage devices. Coordinate delivery with other work to avoid delay.
 - C. Wind Loading: Design and reinforce sectional overhead doors to withstand a 30 lb. per sq. ft. wind loading pressure.
- 1.04 Submittals
 - A. Product Data: Submit manufacturer's product data, roughing-in diagrams, and installation instructions for each type and size of overhead door. Include manufacturer's operating instructions and maintenance data.
 - B. Shop Drawings: Submit shop drawings for special components and installations which are not fully dimensioned or detailed in manufacturer's data.

PART 2 - PRODUCTS

- 2.01 Acceptable Manufacturers
 - A. Manufacturer: Subject to compliance with requirements, provide products of one of the following:
 - 1. Overhead Door Corporation.
 - 2. Ideal Door Company.
 - 3. Equivalent as approved.

- B. Standard of quality for electrically operated sectional steel overhead door shall be 591 Series, commercial thermacore insulated steel sectional door as manufactured by Overhead Door Company, or equal.
- 2.02 Steel Section Doors
 - A. Weather Seals: Rubber tube seals shall be fitted inside every joint between sections to prevent air infiltration. Top section of door shall have EPDM rubber sealing strip. Provide standard jamb seals. Provide EPDM double bottom sealing weatherstrip.
 - B. Insulating Value of Door: R 14.86.
 - C. Finish: Exterior and interior of door sections shall receive <u>shopbaked on primer</u> ready for job finish paint in color as selected by Architect.
 - D. Door sizes shall be as indicated on the drawings.
- 2.03 Tracks. Supports and Accessories
 - A. Tracks: Provide manufacturer's standard galvanized steel tracks for door indicated. Size tracks for door size and weight, and designed for clearances shown. Provide complete track assembly including brackets, bracing and reinforcing required for rigid support. Slope tracks at proper angle from vertical, or otherwise design to ensure tight closure at jambs when door unit is closed. Bolt to track supports.
 - B. Provide high lift.
- 2.04 Hardware
 - A. Provide standard, rust-resistant hardware, with galvanized or cadmium-plated or stainless steel fasteners, to suit type of door.
 - B. Hinges: Provide standard galvanized steel hinges per manufacturer's recommendations for size of door. Attach hinges to door sections.
 - C. Rollers: Provide standard galvanized rollers, with steel ball bearings in case-hardened steel races, mounted with varying projections to suit slope of track.
 - D. Provide electric operation Overhead Door Model RSX ¹/₂HP 208V Single Phase.
 - 1. All overhead doors: pushbutton control stations should be located on interior side.

- 2.05 Counterbalancing Mechanisms
 - A. Torsion Spring: Hang door assembly for operation by torsion spring counterbalance mechanism, consisting of adjustable tension tempered steel torsion springs mounted on a case-hardened steel solid shaft, and connected to door with galvanized aircraft type lift cable.

PART 3 - EXECUTION

- 3.01 Installation
 - A. Door shall be installed by manufacturers authorized dealer. Install door rack, and operating equipment complete with necessary hardware anchors, inserts, hangers, and equipment supports in accordance with final shop drawings, and manufacturer's instructions, and as herein specified.
 - B. Provide bracing, and reinforcing as required for rigid installation of track and door operating equipment.
 - C. Upon completion of installation, including work by other trades, lubricate test and adjust door to operate easily, free from warp, twist, or distortion and fitting weathertight for entire perimeter.

END OF SECTION

SECTION 08410 - ALUMINUM WINDOWS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division - 1 specification sections, apply to Work of this Section.

1.02 DESCRIPTION OF WORK

- A. Extent of aluminum windows is shown on drawings and schedules.
- B. Types of aluminum windows required include the following:
 1. Exterior and Interior
- C. Glazing: Refer to "Glass and Glazing" section of Division 8 for glazing requirements for aluminum entrances, curtain wall and windows, including doors.

D. Sealant around perimeter of aluminum frames is specified elsewhere in Division 7 section.

E. Comply with provisions of Section 01028 - Modification Requirements.

1.03 SYSTEM PERFORMANCES

- A. General: Provide exterior windows assemblies that have been designed and fabricated to comply with requirements for system performance characteristics listed below as demonstrated by testing manufacturer's corresponding stock systems according to test methods designated.
- B. Thermal Movement: Allow for expansion and contraction resulting from ambient temperature range of 120°F (49°C).
- C. Wind Loading: Provide capacity to withstand loading indicated below, tested per ASTM E 330.
 - 1. Uniform pressure of 30 psf inward and 30 psf outward.
- D. Transmission Characteristics of Fixed Framing: Comply with requirements indicated below for transmission characteristics and test methods.
 - 1. Air and Water Leakages: Air infiltration of not more than 0.06 CFM per sq. ft. of

fixed area per ASTM E 283 and no uncontrolled water penetration per ASTM E 331 at pressure differential of 8.0 psf (excluding operable door edges).

- E. Transmission Characteristics of Entrances: Provide entrance doors with jamb and head frames which comply with requirements indicated below for transmission characteristics and test methods.
 - 1. Air Leakage: Air infiltration per linear foot of perimeter crack of not more than 0.50 CFM for single doors and 1.0 CFM for pairs of doors per ASTM E 283 at pressure differential of 1.567 psf.

1.04 QUALITY ASSURANCE

A. Drawings are based on one manufacturer's standard aluminum entrance, curtain wall and windows system. Another standard system of a similar and equivalent nature will be acceptable when differences do not materially detract from design concept or intended performances, as judged solely by Architect.

1.05 SUBMITTALS

- A. Product Data: Submit manufacturer's specifications, standard details, and installation recommendations for components of aluminum entrances and curtain wall and windows required for Project, including test reports certifying that products have been tested and comply with performance requirements.
- B. Shop Drawings: Submit shop drawings for fabrication and installation of aluminum entrances and curtain wall and windows, including elevations, detail sections of typical composite members, hardware mounting heights, anchorages, reinforcement, expansion provisions, and glazing.

1.06 SPECIAL PROJECT WARRANTY

A. Provide written warranty signed by Manufacturer, Installer, and Contractor agreeing to replace aluminum entrances, curtain walls and windows which fail in materials or workmanship within 3 years of acceptance. Failure of materials or workmanship includes excessive leakage or air infiltration, excessive deflections, faulty operation of entrances, deterioration of finish or construction in excess of normal weathering, and defects in hardware, weatherstripping, and other components of the work.

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products which may be incorporated in the work include, but are not limited to, the following:
 - 1. YKK AP America

- 2. Kawneer Company, Inc.
- 3. PPG Industries, Inc.
- 4. Tubelite Div., Indal Inc.
- 5. Amarlite/Arco Metals Co.

2.02 MATERIALS AND ACCESSORIES

- A. Aluminum Members: Alloy and temper recommended by manufacturer for strength, corrosion resistance, and application of required finish; ASTM B 221 for extrusions, ASTM B 209 for sheet/plate.
- B. Fasteners: Aluminum, non-magnetic stainless steel, or other materials warranted by manufacturer to be noncorrosive and compatible with aluminum components.
 - 1. Do not use exposed fasteners except where unavoidable for application of hardware. Match finish of adjoining metal.
 - 2. Provide Phillips flat-head machine screws for exposed fasteners.
- C. Brackets and Reinforcements: Manufacturer's high-strength aluminum units where feasible; otherwise, nonmagnetic stainless steel or hot-dip galvanized steel complying with ASTM A 386.
- D. Concrete/Masonry Inserts: Cast iron, malleable iron, or hot-dip galvanized steel complying with ASTM A 386.
- E. Bituminous Coatings: Cold-applied asphalt mastic complying with SSPC-PS 12, compounded for 30-mil thickness per coat.
- F. Compression Weatherstripping: Manufacturer's standard replaceable stripping of either molded neoprene gaskets complying with ASTM D 2000 or molded PVC gaskets complying with ASTM D 2287. Weatherstripping shall be equal to Kawneer Sealair Weathering System which shall include head and jamb, astragal, and bottom weatherstripping.
- G. Glazing Materials: Provide manufacturers standard EDPM glazing gaskets.
- H. Sealant: Provide all sealant necessary within aluminum assemblies. Perimeter sealant around frames shall be included under Section 07900.

2.03 FABRICATION

- A. General Sizes and Profiles: Required sizes for frame units, including profile requirements, are indicated on drawings.
 - 1. Details shown are based upon standard details by manufacturer indicated. Similar details by other manufacturers listed will be acceptable, provided they comply with other requirements, including profile limitations.

- B. Prefabrication: To greatest extent possible, complete fabrication, assembly, finishing, hardware application, and other work before shipment to project site. Disassemble components only as necessary for shipment and installation.
 - 1. Do not drill and tap for surface-mounted hardware items until time of installation at project site.
 - 2. Perform fabrication operations, including cutting, fitting, forming, drilling, and grinding of metal work in manner which prevents damage to exposed finish surfaces. For hardware, perform these operations prior to application of finishes.
- C. Reinforcing: Install reinforcing as necessary for performance requirements; separate dissimilar metals with bituminous paint or other separator which will prevent corrosion.
- D. Continuity: Maintain accurate relation of planes and angles, with hairline fit of contacting members.
- E. Fasteners: Conceal fasteners wherever possible.
- F. Weatherstripping: For exterior windows, provide compression weatherstripping against fixed stops.

2.04 ALUMINUM WINDOWS

- A. All exterior windows: YKK Model YES 45TU System (2" x 4¹/₂) for 1" glazing, thermally broken or equal.
 - 1. YES 40FS interior aluminum frame, $1\frac{3}{4}$ " x 4" non-insulated.

2.05 FINISH

A. All exposed aluminum surfaces shall be free of scratches and other serious blemishes.
1. Finish shall be YKK standard YB5N, dark bronze.

PART 3 - EXECUTION

3.01 INSTALLATION

- A. Comply with manufacturer's instructions and recommendations for installation of aluminum entrances, curtain wall and windows.
- B. Drill and tap frames and doors and apply surface-mounted hardware items, complying with hardware manufacturer's instructions and template requirements. Use concealed fasteners wherever possible.

- C. Set sill members and other members in bed of sealant to provide weathertight construction.
- D. Refer to "Glass and Glazing" section of Division 8 for their installation of glass shown to be glazed into doors and framing.

3.02 ADJUST AND CLEAN

- A. Adjust operating hardware to function properly, without binding, and to provide tight fit at contact points and weatherstripping.
- B. Clean completed system, inside and out, promptly after erection and installation of glass and sealants. Remove excess glazing and sealants, dirt, and other substances from aluminum surfaces.
- C. Institute protective measures and other precautions required to assure that aluminum entrances and curtain wall and windows will be without damage or deterioration other than normal weathering at time of acceptance.

END OF SECTION

SECTION 08710 – FINISH HARDWARE

PART 1 – GENERAL

1.01 Related Documents

Drawings and general provisions of contract and Division 1 specification sections, apply to work of this section

1.02 SUMMARY

Work under this heading includes furnishing all hardware to respective trades. The hardware supplier shall promptly furnish templates to all manufacturers furnishing materials necessary for completion of this part.

Extent of finish hardware is indicated on drawing and in schedules.

The following specifications are a guide and a description of the quality materials required. No material of quality or weight less than outlined in this specification will be accepted. The contractor will be responsible for supplying the correct quantity of all materials, whether or not specifically mentioned in this specification. Any additional items that may be required shall be furnished and be of type, quality, and utility consistent with other hardware specified.

1.03 SUBMITTALS

ARCHITECT'S HARDWARE SCHEDULE:

Architect's hardware schedule is by hardware set number. Refer to drawings for designation of hardware set number applicable to each opening. Certain additional items of hardware and/or hardware accessories specified herein shall be finished and noted on the hardware schedule.

SUPPLIER'S HARDWARE SCHEDULE

A complete hardware schedule, indicating type, number, location, and finish shall be submitted to architect for approval, together with such samples as may be required for review. Opening numbers shall be same as used in contract documents. Schedule shall be prepared according to <u>Door and Hardware Institute</u> recommendations (schedule and sequence format) and shall include degree of door closer installation. Supplier's hardware schedule will be reviewed by architect for type, quality, finish, and for function (other than hand). Contractor shall be responsible for checking schedule for correct hand of locksets and for supplying quantity of items required by contract documents. Provide supplementary or revised hardware schedules if deemed necessary by architect. Do not ship or deliver hardware to job prior to review of hardware schedules by architect. Hardware schedule shall be submitted in the following format. Hardware schedules submitted to architect for review not in this format will be rejected:

HARDWARE HEADING 1

1 Sgl Door #001	Exterior	from	Corridor	RHR	90 deg
-	Each leaf 3'0 x	7'0 x HMF x	NLWD		-

Item, quantity, manufacturer's #, size, product type, finish, and product information

3 ea	Hinge	5BB1 NRP 4.5 x 4.5	630	IV
1 ea	Cylinder	951 x GGMK	26D	FA
1 ea	Exit Device	25R L Dane x 3070 x RHR	32D	FA
Etc.				

1.04 QUALITY ASSURANCE

All hardware shall be furnished by an established Builders Hardware firm who maintains and operates an office, display, and stock in this area, and who is a regular authorized distributor of the lock he proposes to furnish. All hardware schedules submitted for approval shall carry the signature and seal of a certified Architectural Hardware Consultant who is employed by the hardware firm supplying material.

1.05 PROJECT CONDITIONS

Delivery storage and handling: Hardware supplier shall receive and check all hardware at his warehouse. Drop shipments to the jobsite from various manufacturers will not be permitted. All hardware shall be in its original packaging and plainly labeled and numbered to agree with the numbers and as listed in the hardware schedule. The contractor shall submit his schedules for approval to the architect before proceeding with any work. When required, hardware supplier shall deliver hardware and/or hardware templates to the various door manufacturers. The general contractor shall provide storage facilities for the finish hardware after delivery to the job site.

1.06 ITEMS NOT INCLUDED

Hardware for metal windows, toilet partitions, cabinets, access panels, etc. is not included in this section. See other sections for hardware to be furnished by others. Reference Division 16 for electrical requirements.

PART 2 – PRODUCTS

2.01 MANUFACTURERS

Numbers given in this schedule are of the following manufacturers.

PRODUCTS	MFG. SPECIFIED	APPROVED EQUAL
Falcon	Key cylinders and cores	No Substitutions allowed
Hinge	IVES	Hager, Bommer
Locks	Falcon	Schlage Lock
Exits	Falcon	Von Duprin
Closers	LCN	Sargent
Trim/Auxiliary	Hager Companies	Rockwood, Ives
Weather Strip	Hager Companies	NGP, Pemko

2.02 HARDWARE FINISHES

The designations used to indicate hardware finishes are those listed in ANSI /BHMA A156.18, "Materials and Finishes", including coordination with the traditional U.S. finishes, shown by certain manufacturers for their products.

1.	Butt Hinges	US26D (652) Satin Chrome US32D (630) Satin Stainless Steel
2.	Mortise Cylinders, Rim Cylinders, and "Permanent" Interchangeable Core	US26D (626) Satin Chrome s
3.	Cylindrical Latch sets and Locksets	US26D (626) Satin Chrome
4.	Exit Devices	US26D (626) Satin Chrome
5.	Door Closers	ALUM (689) Powder Coat Aluminum
6.	Wall and Floor Stops	US32D (630) Satin Chrome
7.	Door Pulls	US32D (630) Satin Chrome
8.	Push Plates	US32D (630) Satin Chrome
9.	Mop, Kick, and Armor Plates	US32D (630) Satin Chrome
10.	Saddle Thresholds	Mill Finish Aluminum, Uncoated
11.	Door Sweeps	Satin Aluminum, Clear Anodized
12.	Self Adhesive Seals	Charcoal
13.	Door Silencers	Gray Gray (Rubber)

2.03 HINGES

Characteristics:

- a. Tested to be in accordance with ANSI / BHMA A156.1.
- b. Templates: Provide only template-produced units.
- c. Fasteners: Provide Phillips flat-head screws complying with the following requirements.
 - (1) For metal doors and frames, install machine screws into drilled and tapped holes.
 - (2) For wood doors and frames, install threaded-to-the-head wood screws.
 - (3) For fire-rated wood doors, install #12 x 1-1/4 inch, threaded-tothe-head steel wood screws.
 - (4) Finish screw heads to match surface of hinges or pivots.
- d. Hinge Pins: Except as otherwise indicated, provide hinge pins as follows:
 - (1) Out-Swing Exterior Doors: Non-removable pins.
 - (2) Out-Swing Interior Doors: Non-rising pins and Non-removable pins; as indicated in the Door Hardware Sets.
 - (3) In-Swing Exterior / Interior Doors: Non-rising pins.
 - (4) Tips: Flat button and matching plug. Finished to match hinge leaves.
- e. Size: Size hinges in accordance with the specified manufacturer's published recommendations.
- f. Quantity: Furnish one pair of hinges for all doors up to 5'-0" high.

Furnish one additional hinge for each additional 2-1/2 feet or fraction thereof.

2.04 CYLINDERS and KEYS

Characteristics:

- a. Tested to be in accordance with ANSI / BHMA A156.28.
- b. "Equip all cylinders and locksets with, a minimum of, 7-pin interchangeable core, tumbler cylinders. FALCON SFIC "A" keyway
- c. Provide a NEW Key System for this Project.
- d. Furnish cylinders and locksets with temporary, brass / keyed, "Construction" interchangeable cores for the duration of the time of construction. Construction cores, master keys, and control keys shall not be part of the Owner's Permanent Key System or furnished on the same keyway (or key section) as the Owner's Permanent Key System. Construction cores, master keys, and control keys are the property of the manufacturer and shall be returned when the Permanent cores and keys are installed. Remove these "Construction" interchangeable cores <u>ONLY</u> when directed by the Architect and / or Owner.
- e. Furnish final "Permanent" interchangeable cores and keys, for installation by the Owner.
- f. Metals: Construct lock cylinder parts from brass or bronze, stainless steel, or nickel silver.

- g. Comply with the Owner's instructions for keying requirements and, except as otherwise indicated, provide individual change keys for each lock that is not designated to be keyed alike with a group of related locks. All keys are to be:
 - (1) Permanently inscribe each key with number of lock that identifies the cylinder manufacturer's key symbol, and notation, "DO NOT DUPLICATE".
- h. A key meeting between the Owner and a representative of the successful finish hardware distributor shall be arranged subsequent to the return of the Approved Finish Hardware Schedule. A keying schedule will be established by the finish hardware distributor's representative and submitted to the Owner, for Approval. After the Owner's review, the keying schedule shall be returned to the distributor's representative such that the Permanent cores and keys can be prepared on a timely basis.
- i. Permanent cores and keys will be transmitted directly to the Owner by the Finish Hardware Distributor. The Owner shall be responsible for the installation of the Permanent cores and the return of the Construction cores and keys.
- j. Key Material: Provide keys of nickel silver only.
- k. Key Quantities: Furnish the following quantities of keys for the entire project.
 - (1) Ten (10) Each Construction Master Keys
 - (2) Two (2) Each Construction Control Keys
 - (3) Five (5) Each Permanent Master Keys
 - (4) Two (2) Each Permanent Control Keys
 - (5) Three (3) Each Permanent Change Keys

(For Each Keyed Door Opening)

The "Exterior" and "Interior" Permanent Interchangeable Cores Cylinders shall be operated by the same key system.

Deliver all <u>Construction</u> interchangeable cores and keys to the General Contractor. Deliver all <u>Permanent</u> interchangeable cores and keys to the Owner, via Registered Mail.

2.05 Cylindrical Locksets

Characteristics:

- a. Tested to be in accordance with or exceed ANSI / BHMA A156.2 Series 4000, Grade 2 Strength
- b. U.L. Listed for 3-hour doors.
- c. Levers and roses as specified in sets
- d. Manufactured by FALCON Lock Company.

2.06 EXIT DEVICES:

Characteristics:

a. Tested to be in accordance with ANSI A156.3, 1994, Grade 1. All exit devices to be heavy duty, with one-piece removable covers. The housing shall be manufactured from extruded aluminum without exposed screws or rivets.

- Exit Devices shall be "UL" listed for Life Safety. All exit devices for fire-rated door openings shall have "UL" labels for "Fire Exit Hardware".
 All exit devices shall conform to NFPA 80 and NFPA 101 requirements.
- c. All series exit devices shall be "touchpad" (modern) types, incorporating a hydraulic fluid damper, which decelerates the touchpad on its return stroke and eliminates noise associated with the exit device operation.
 All exit devices shall be non-handed. The touchpad shall extend a minimum of 1/2 of the door width and shall be a minimum of 2-3/16" in height. Plastic touch pads shall not be acceptable. The touchpad height shall exceed height of mechanism case or rail assembly to eliminate "Pinch Points". If the touchpad height does not exceed the height of the mechanism case or rail assembly, provide a factory installed insert / filler on the top and bottom of the touchpad along the mechanism case and rail assembly; to prevent "Pinch Points".
- d. All latch bolts to be the deadlocking type. Latch bolts shall have a self-lubricating coating to reduce wear. Plated or plastic coated latch bolts shall not be acceptable.
- e. All metal end caps to be standard with all exit devices.
- f. Exit device strikes, where surface applied, shall be a roller type and have an anti-slip mounting plate.
- g. All outside exit device trim shall be forged brass, full escutcheon. The pull shall have a grip that is $6 \frac{1}{4}$ CTC and project 2 11/16".
- h. The exit device end caps shall be secured with three (3) screws to a truss bracket.
- i. The "touchpad" exit devices shall be patterned punched to designate code requirements; where required.
- j. All exit devices shall be made of brass, bronze, stainless steel, or aluminum material, plated to the standard architectural finishes to match the balance of the door hardware.

2.06 CLOSERS

Characteristics:

- a. Door closers shall have fully hydraulic, full rack and pinion action with a high strength cast iron cylinder; which have been tested and certified under ANSI / BHMA Standard A156.4, Grade 1.
- Hydraulic fluid shall be of a type requiring no seasonal closer adjustment for temperatures ranging from 120 degrees F (49 degrees C) to -30 degrees F (-35 degrees C).
- c. Spring power shall be continuously adjustable over the full range of closer sizes, and allowing for reduced opening force for the physically handicapped. Hydraulic regulations shall be by tamper-proof, non-critical valves. Closers shall have separate adjustment for latch speed, general speed and back check.
- d. All closers shall have solid forged steel main arms (and forearms for parallel arm closers) and where specified shall have a spring loaded stop in the soffit shoe ("SPRING CUSH-N-STOP"); as indicated in the Door Hardware Sets. Where door travel on out-swing doors must be limited, use SPRING CUSH-N-STOP type closers. Auxiliary stops are not required when SPRING CUSH-N-STOP type closers are used.
- e. All closers shall have non-metallic full, plastic, covers, which provides complete enclosure.

- f. All closers shall be certified to exceed <u>Ten Million</u> (<u>10,000,000</u>) full load cycles by a recognized independent testing laboratory. All closers shall be of one manufacturer and shall maintain the manufacturer's ten year warranty.
- g. Access-Free Manual Closers: Where manual closers are indicated for doors required to be accessible to the physically handicapped, provide adjustable units complying with ADA and ANSI A117.1 provisions for door opening force.
- h. All closers shall be attached utilizing Through Bolts with Wood and Machine Screws ("TBWMS").
- i. Closers to be installed to allow door swing as shown on plans. Doors swinging into exit corridors shall provide for corridor clear width as required by code. Where possible, mount closers inside rooms.
- j. Powder coating finish to be certified to exceed 100 hours salt spray testing by ETL, an independent testing laboratory used by BHMA for ANSI certification.

Lacquer or painted finish on metal components shall not be acceptable.

2.08 PUSH AND PULL UNITS

PULL UNITS:

Characteristics:

- a. Tested to be in accordance with ANSI / BHMA A156.6, Grade 1.
- b. Door Pulls shall be made of 1" diameter material, Semi-Circular offset, 11" Center-To-Center length, with a minimum of a 3-1/4" projection, and a 2-1/4" clearance. The door pulls shall comply with the recommendations of the Americans with Disabilities Act (A.D.A.).
- c. Provide door pulls with 1/8" thick base washers; as indicated in the Door Hardware Sets.
- d. Fasteners: Provide two (2) 5/16-18 x 2-1/4" machine screws with 1" Diameter Decorative Thru-Bolts.
- e. Custom pulls shall be manufactured by Rockwood, product numbers listed in hardware sets.

PUSH PLATES:

Characteristics:

- a. Tested to be in accordance with ANSI / BHMA A156.6, Grade 1.
- b. Push Plates shall be made of .050" wrought, stainless steel material.
- c. Where detailed, provide 8" x 16" "Half Circle".
- d. Where detailed, provide push plates cut for a cylinder (CFC).
- e. Provide exposed, Phillips oval head, stainless steel, sheet metal screw, mounting fasteners, for all plates.

2.09 PROTECTIVE PLATES

Characteristics:

- a. Tested to be in accordance with ANSI / BHMA A156.6, Grade 1.
- b. All mop, kick, and armor plates shall be US18 gauge (.050") thick of stainless steel material.
- c. Fabricate mop plates not more than 1 inch less than door width, on the "PULL" side, kick plates not more than 1-1/2 or 2 inches less than door width, on the "PUSH" side, and armor plates not more than 1-1/2 inches less than door width, on the "PUSH" side.
- d. Heights:
- (1) Mop Plates shall be 4 inches in height.
- (2) Kick Plates shall be 8 inches in height.
- (3) Armor Plates shall be 36 inches in height.
- e. Where detailed bevel all four (4) edges ("B4E").
- f. Provide mop, kick, and armor plates with #6 x 5/8" Oval Head, Stainless Steel, Sheet Metal Screws.

2.10 THRESHOLDS

Characteristics:

- a. All thresholds shall be certified by an independent testing laboratory to meet the requirements of ANSI / BHMA A156.21.
- b. All thresholds shall be in accordance with the requirements of A.D.A.A.G. and ICC / ANSI A117.1.
- c. Thresholds shall be furnished in an aluminum extrusion that is of alloy 6063 hardness T-5.
- d. Provide thresholds with 1/4-20 Stainless Steel Machine Screws and Lead Anchors.

2.11 DOOR STOP

Characteristics:

- a. Tested to be in accordance with ANSI / BHMA A156.16, Grade 1.
- b. Wall Bumpers shall have a solid forged brass housing with a concealed, in the concave bumper, attachment. Provide with wood screw and plastic anchors.
- c. Floor Stops shall be made from solid cast brass or bronze. Provide with machine screws and lead expansion shield anchors.
- d. Install floor stops in such a position that they permit maximum door swing, but do not present a hazard or obstruction.

2.12 SILENCERS

Provide GJ-64 silencers for all hollow metal frames. Single doors shall have three (3) silencers. Double doors shall have two (2) silencers.

PART 3 – EXECUTION

3.01 APPLICATION

INSTALLATION: Work shall be done by a craftsman skilled and experienced in installation of finish hardware. Mortised items shall be neatly set in and made flush with door or frame surface. Manufacturer's instructions and recommendations shall be strictly followed.

FASTENERS: Hinges, pivots, locks, and exit devices shall be installed with proper sex bolts, wood or machine screws as supplied by the manufacturer. Surface closers shall be mounted to door with sex bolts. Door pulls shall be installed on doors with thru-bolts as supplied by manufacturer.

3.02 ADJUSTING, CLEANING, AND DEMONSTRATING

- A. Adjust and check each operating item of hardware and each door to ensure proper operation or function of every unit. Replace units that cannot be adjusted to operate freely and smoothly or as intended for the application made.
 - 1. Where door hardware is installed more than one month prior to acceptance or occupancy of a space or area, return to the installation during the week prior to acceptance or occupancy to execute final check and adjustment of all hardware items in such space or area. Clean operating items as necessary to restore proper function and finish of hardware and doors. Adjust door control devices to compensate for final operation of heating and ventilating equipment.
- B. Clean adjacent surfaces soiled by hardware installation.
- C. Door Hardware Supplier's Field Service:

3.04 Hardware Sets (McCreary Spec Pine Knot Fit-up)

Hardware Set 1 - Tag # 1, 2, 3, 6, 7 , 8, 9, 10

Cylinders	As needed		626
Hardware Set 2 – Tag # 1	1, 12A, 24		
Ball Bearing Hinges Office Lock Convex Wall Stop	5BB1 B511 GD 232W	4 ½ x 4 ½ Dane	652 626 630
For Door # 11 use: 1 ea Threshold 513 2 sets seals 5050 1 auto door bottom 780SA	,		
Hardware Set 3 – Tag # 1	2B		
Ball Bearing Hinges Passage Latch Set Surface Overhead Stop	5BB1 B101S 450 Series	4 ½ x 4 ½ Dane	652 626 630
Hardware Set 4 – Tag # 2	22		
Ball Bearing Hinges Mortise Cylinder Rim Exit Device Cush Arm Closer Smoke Seal	5BB1 C987 25R-NL 1461 721B	4 ½ x 4 ½ Cush	652 626 626 689 BLK
Hardware Set 5– Tag # 1	4, 15, 16		
Ball Bearing Hinges Storeroom Lock Door Closer Convex Wall Stop	5BB1 B581 GD 1461 232W	4 ½ x 4 ½ Dane R w/PA	652 626 689 630
Hardware Set 6 – Tag # 19B			
Ball Bearing Hinges Flush Bolt Classroom Lock Door Closer	5BB1 282D-12 B561 GD 1461	4 ½ x 4 ½ top & bottom Dane R w/PA	652 626 626 689

Surface Overhead Stop	450 Series	630
Smoke Seal	721B	BLK

Hardware Set 7 – Tag # 23

Ball Bearing Hinges	5BB1	4 ½ x 4 ½	652
Mortise Privacy Indicator	MA311	DGM	626
Door Closer	1461	R w/PA	689
Convex Wall Stop	232W		630

Hardware Set 8– Tag # 13

Ball Bearing Hinges	5BB1	4 ½ x 4 ½	652
Classroom Lock	B561 GD	Dane	626
Cush Arm Closer	1461	Cush	689
Smoke Seal	721B		BLK

Hardware Set 9 - Tag # 17, 18, 20, 21

Ball Bearing Hinges	5BB1	4 ½ x 4 ½	652
Push Plate	30S	8 x 16	630
Pull	2J	4 x 16 plate	630
Door Closer	1461	H Cush	689
Armor Plate	190S	30" x 1" LTDW	630

Hardware Set 10 – Tag # 19A

Ball Bearing Hinges	5BB1	4 ½ x 4 ½	652
Mortise Cylinder	C987		626
Rim Exit Device	F25R-NL		626
Door Closer	1461		689
Smoke Seal	721B		BLK

Hardware Set 11 – Tag # 26

Ball Bearing Hinges	5BB1 NRP	4 ½ x 4 ½	630
Mortise Cylinder	C987		626
Rim Exit Device	25R-L		626
Parallel Arm Closer	1461	R w/PA	689
Saddle Threshold	412S		MIL
Door Sweep	759S-V		MIL
Weather Strip	736S	17'	BLK
Weather Strip	870S-N	3070	MIL

SECTION 08800 - GLASS AND GLAZING

PART 1 - SCOPE

A. This Section includes all labor, materials, equipment and related items required for the work of glass and glazing as shown on the Drawings and specified herein.

PART 2 - SUBMITTALS

- A. The Contractor shall submit to the Architect for approval prior to furnishing materials at the job site, in five (5) copies, manufacturer's specifications, application and performance data, etc. for all glass and glazing materials, except miscellaneous accessories specified hereunder.
- B. Samples. The Contractor shall submit if requested to the Architect for approval prior to furnishing materials at the job site, duplicate samples of the following:
 - 1. Glass of each type, not less than 3" x 5".
 - 2. Glazing compound, one (1) cartridge.

PART 3 - CODES AND STANDARDS

- A. All glazing compounds and methods of glazing shall be in accordance with applicable portions of the Flat Glass Marketing Association's "Glazing Manual", latest edition.
- B. All safety glazing shall meet requirements of the Kentucky Department of Housing, Buildings, and Construction and appropriate Kentucky Revised Statutes.

PART 4 - PRODUCT HANDLING

A. Glass shall be delivered to the job and shall be stored on end and under cover. Glass shall be properly crated, packaged, and protected from damage. Glazing compounds shall be delivered in manufacturer's sealed containers, with attached labels properly identifying the types.

PART 5 - MATERIALS

- A. Insulating glass for installation in aluminum windows shall be of sizes shown, composed of outer and inner panes of ¹/₄" (for color, see elevations) /¹/₄" clear .548, 1" O.A., by LOF separated by a ¹/₂" dehydrated air space. Each unit shall be hermetically sealed and glass shall be separated by a spacer around the edges as standard with the manufacturer.
 - 1. Warranty. Each unit shall be guaranteed by the manufacturer not to develop, under normal conditions, material obstruction of vision as a result of film formation on the internal glass surfaces caused by failure of the hermetic seal other than through glass breakage for a period of ten (10) years.

- B. Compound for glazing in openings other than those which are dry-glazed shall be nonstaining, one-part polysulfide base sealant, and shall be PRC "Rubber Caulk 5000", Pecora "Synthacalk GC-9", or DAP "Flexiseal". Color of compound shall be manufacturer's standard as selected by the Architect.
- C. Miscellaneous Items. Provide neoprene spacers, setting blocks, clips, and all accessories required for the work of glazing.
- D. Other material shall be as specified hereinafter.

PART 6 - GLAZING

- A. General Requirements:
 - 1. Glazing shall be done in a weathertight and waterproof manner. No glazing work shall be done when the temperature is below 40 degree F.
 - 2. Glazing surfaces shall be extremely clean, dry and completely dust free before commencing application of glazing materials.
 - 3. Remove glazing beads completely, perform glazing operations and set back in correct location. Do not mar beads, screws and the like.
 - 4. Glazing shall be done at the building after windows, frames, doors, etc. are installed.
 - 5. Remove excess glazing compound from glass and other adjacent surfaces to prevent permanent stains or other damage.
- B. Aluminum entrance doors and fixed window frames shall be glazed in strict accordance with entrance manufacturer's instructions and details for these operations.

PART 7 - CLEANING

A. At completion, remove dirt, stains, etc. from glass. Wash and polish glass inside and outside surfaces. Exercise care so as not scratch or damage glass. Do not use acid solution or water containing caustic soaps. Leave work in perfect condition as approved by the Architect.

End of Section

SECTION 09260 - GYPSUM BOARD

PART 1 - GENERAL

1.01 SUMMARY

- A. Related Documents: Provisions established in General and Supplementary Conditions of the Contract, Division 1 General Requirements, and the Drawings are collectively applicable to this Section.
- B. Section Includes:
 - 1. Interior metal stud wall framing studs, 20 gage material thickness.
 - 2. Furred wall framing.
 - 3. Metal channel ceiling framing.
 - 4. Gypsum board.
 - 5. Cementitious backer board.
 - 6. Taped and sanded joint treatment.

1.02 SUBMITTALS

- A. Submit under provisions of Section 01330.
- B. Product Data: Provide data on metal framing, gypsum board, joint tape and joint compound.
- C. Submit manufacturer's installation instructions for each product proposed for use.

1.03 QUALITY ASSURANCE

A. Perform Work in accordance with ASTM C 840, GA-201, GA-216 and GA-600.

1.04 DELIVERY, STORAGE, HANDLING

- A. Deliver, store, handle, and protect products in conformance with manufacturer's instructions and in accordance with Section 01600.
- B. Store inside building, on sleepers, and out of water.

1.05 QUALIFICATIONS

A. Applicator: Company specializing in performing the work of this section with minimum of 3 years documented experience.

1.06 REGULATORY REQUIREMENTS

- A. Conform to applicable code for fire rated assemblies.
- B. Refer to Drawings for details and references to UL and GA assemblies.

PART 2 - PRODUCTS

2.01 MANUFACTURERS - GYPSUM BOARD

- A. Acceptable Manufacturers: Subject to compliance with requirements indicated, provide products of one of the following:
 - 1. U. S. Gypsum.
 - 2. Georgia-Pacific Gypsum, LLC.
 - 3. National Gypsum.
 - 4. Domtar Gypsum Co.
 - 5. Republic Gypsum Co.
- B. Substitutions: Under provisions of Section 01600.
- C. Specific product references are these of U.S. Gypsum Company unless noted otherwise as a standard of quality.

2.02 GYPSUM BOARD MATERIALS

- A. Fire Rated Gypsum Board: ASTM C 36; fire resistive type X or C, UL rated; 48 inch by 5/8 inch thick, maximum permissible length; ends square cut, tapered and beveled edges.
- B. Moisture Resistant Gypsum Board: ASTM C 630; 48 by 5/8-inch thick, type X or C (fire-rated), maximum permissible length ends square cut, tapered edges.
- C. Gypsum Backing Board: ASTM C 442; fire rated type 'X'; 5/8-inch thick; V-grooved edges, ends square cut, maximum permissible length.
- D. Exterior Gypsum Sheathing shall be Fiberglass, Mat-Faced Gypsum Sheathing, Type X, Densglass Fireguard Sheathing, or equal.

2.03 MANUFACTURERS - FRAMING SYSTEMS

- A. Acceptable Manufacturers: Subject to compliance with requirements indicated, provide products of one of the following:
 - 1. Clark Steel Framing Systems, Inc., Hinckley, OH.
 - 2. Consolidated Systems, Inc., Columbia, SC
 - 3. Dale/Incor Industries, Dearborn, MI.
 - 4. Delta Metal Products, Dallas, TX.
 - 5. Dietrich Industries, Inc., Hutchins, TX.
- 6. Knorr Steel Framing Systems. Salem, OR.
- 7. The Steel Network Inc., Raleigh, NC.
- 8. Unimast, Inc., Houston, TX
- 9. Western Metal, Riverside, CA.
- B. Substitutions: Under provisions of Section 01600.

2.04 FRAMING MATERIALS

- A. Studs and Tracks: ASTM C 645; galvanized sheet steel, gage as indicated on Drawings, 'ST' series shape, depths as indicated on Drawings. Provide with floor and ceiling runners, 'C' shaped galvanized, 1-1/4 inch leg.
- B. Shaft Wall Studs: Galvanized finish, length and depth as required, gage as recommended by manufacturer for heights encountered to maintain a maximum deflection of L/240 with 5 pound horizontal loading.
- C. Furring, Framing and Accessories: Provide in conformance with ASTM C 645, GA-216, and GA-600 and as follows:
 - 1. Cold Rolled Channels: 3/4inch, 1-1/2 inch and 2 inches, 16 gage, prime painted.
 - 2. Furring Channels: 7/8 inch deep x 1-1/4 inch face, 25 gage, galvanized.
 - 3. Resilient Furring: 7/8 inch deep x 1-1/4 inch face, 25 gage, galvanized with one leg attached only.
- D. Fasteners: ASTM C 514 for nails and C 1002 for screws as follows:
 - 1. Inserts, clips, bolts, nails or other screws as recommended by manufacturer, of type and size to suit application and to rigidly secure materials in place.
 - 2. Self-drilling, self-tapping bugle head screws for use with power drive tool.
 - 3. Metal Framing to Structure: Power driven screw fasteners to withstand 190 pound single shear resistance and 200 pound bearing force when drive through structural head or base and without exceeding allowable design stress in runner, fastener, or structural support.
 - 4. Metal to Metal: 3/8 inch, Type S or S-12, pan head screws.
 - 5. Gypsum Board to Sheet Metal Application: Type S screws.
 - 6. Gypsum Board to Gypsum Board Application: Type G screws.

- 7. Vertical Deflection Connection (required under all steel beams where the top metal track is tied into the steel beam): Provide VertiClip® or VertiTrack[™] deflection-accommodating anchorage devices, by The Steel Network Inc. Products shall conform to the following material properties and performance criteria:
 - a. Code Criteria:
 - 1. Meet required head of wall connection criteria as required by applicable referenced code for cyclic wall movement.
 - b. Material Composition: Meeting ASTM A653/A, SS grade 50, class 1, 50 ksi minimum yield strength, 65 ksi minimum tensile strength, G-60 hot dipped galvanized coating.
 - c. Material Thickness: 0.036 inch thick for VertiClip SLD series.
 - d. Clips shall be designed for positive attachment to structure and stud web using step-bushing technology to provide frictionless vertical movement.
 - e. Provide clips with attached bushing and screw of the series, size, and configuration as recommended by manufacturer.
 - f. Friction-fit deep-leg track assemblies and tracks relying on steel flexure to perform are unacceptable.
 - g. Substitutions: Must comply with the following:
 - 1. Meets ASTM A653/A, SS Grade 50, class 1 50 ksi minimum yield strength, 65 ksi minimum tensile strength, G-60 hot dipped galvanized coating.
 - 2. Certified for use in UL 2079-approved assemblies for cyclic movement.
 - 3. Structural testing performed per AISI requirements.

2.05 ACCESSORIES

- A. U. S. Gypsum Company products specified below as a standard of quality, unless noted otherwise.
 - 1. Acoustical Insulation: Refer to Section 07210.
 - 2. Acoustical Sealant and Tape: Non-hardening, non- skinning, for use in conjunction with gypsum board; manufactured by Tremco, Pecora, or USG.
 - 3. Corner Beads: Metal, equal to USG Durabead No. 103, galvanized.

- 4. Casing Beads: Equal to USG No. 200-A, galvanized. 5.
- 5. Control Joint: Equal to USG No. 093, galvanized.
- 6. Hanger Wire: Annealed galvanized wire, of gauges indicated (or required to suit application) to rigidly support ceiling components in place.
- B. Joint Treatment and Texture Materials
 - 1. Joint Tape:
 - a. ASTM C 475 or FS SS-J-570, Type II, perforated tape.
 - b. Joint compound:
 - 1. ASTM C 475 or FS SS-J-570, Type I.
 - 2. Acceptable Product:
 - i) Taping compound: USG Durabond Joint Compound Taping.
 - ii) Topping: USG Joint Compound-All Purpose.
- C. Reveal Moldings
 - 1. Extruded aluminum, 6063 T5 alloy, clear anodized unless otherwise noted, in profiles as indicated on the Drawings, as made by Pittcon or Fry Reglet.

PART 3 - EXECUTION

3.01 INSPECTION

- A. Verify that site conditions are ready to receive work and opening dimensions are as indicated on shop drawings and instructed by the manufacturer.
- B. Beginning of installation means acceptance of existing substrate.

3.02 METAL STUD INSTALLATION

- A. Follow recommendations of U.S. Gypsum Co., "Gypsum Construction Handbook".
- B. Install studding in accordance with ASTM C 754, GA-201, GA- 216, and GA-600.
- C. Metal Stud Spacing: 16 inches on center, unless otherwise noted in schedule or on Drawings. Locate studs maximum of 2 inches from door frames, abutting partitions, corners, and other construction features.

- D. Stud to Structure: Refer to Drawings for indication of partitions extending stud framing through the ceiling to the structure above. Provide vertical deflection accommodating devices where each stud connects to structural members above.
- E. Stud to Ceiling: Refer to Drawings for indication of partitions extending to finished ceiling only and for partitions extending through the ceiling to the structure above.
- F. Door Opening Framing: Install double studs at door frame jambs. Install stud tracks on each side of opening, at frame head height, and between studs and adjacent studs.
- G. Blocking: Screw wood blocking to studs. Bolt or screw steel channels to studs. Install blocking for support of plumbing fixtures, toilet partitions, wall cabinets, shelving, toilet accessories, and hardware.
- H. Coordinate installation of bucks, anchors, blocking, electrical and mechanical work placed in or behind partition framing.
- I. Stud Connections: Secure studs to runners with screws at door and window frames, partition intersections and corners. Where required for additional height, splice studs by nesting a minimum lap of 18 inches and attach flanges together with 2 screws in each flange. Prevent structural loading of stud systems.
- J. Restroom Chase Wall Studs: Position double row of studs vertically in runners so that studs are opposite each other in pairs with flanges pointed in same direction. Space at 16 inches on center unless otherwise noted. Anchor each stud to runner flanges with screws. Cross brace between rows of studs with wallboard, 12 inches by chase width, screw attached to stud webs at quarter points in partition height, with 1 inch screws spaced 8" off center in each stud web.
- K. Seismic Requirements: Provide lateral bracing and other measures in accordance with seismic requirements of applicable codes and regulations.

3.03 WALL FURRING INSTALLATION

- A. Erect wall furring for direct attachment to concrete block and concrete walls.
- B. Erect furring channels vertically. Secure in place on alternate channel flanges at maximum 24 inches on center.
- C. Space furring channels maximum 16 inches off center, not more than 4 inches from floor, ceiling lines and abutting walls.
- D. Erect free-standing metal stud framing tight to concrete and concrete masonry walls, attached by adjustable furring brackets in accordance with manufacturer's instructions.

3.04 FURRING FOR FIRE RATINGS

A. Install furring as required for fire resistance ratings indicated.

3.05 SHAFT WALL INSTALLATION

A. Shaftwall Framing: In accordance with manufacturer's installation instructions. Space studs at 16 inches on center. Cut so that studs are no more than 1/2 inch shorter than rough opening.

3.06 CEILING FRAMING INSTALLATION

- A. Install in accordance with ASTM C 754, GA-201, GA-216, and GA-600 and manufacturer's instructions.
- B. Coordinate location of hangers with other work. Use 9 gage wire for single layer wall board, and 8 gage wire for double layer. Space at maximum 48 inches on center each way, unless ceiling framing occurs at more frequent intervals.
- C. Install ceiling framing independent of walls, columns, and above-ceiling work. Locate members within 6 inches of walls. Unless shown otherwise, use 1-1/2 inch cold-rolled channels, 2 inch on double layer board, at 48 inches off center main framing with furring channels at 24 inches on center, 16 inches on center for double layer board.
- D. Reinforce openings in ceiling suspension system which interrupt main carrying channels or furring channels, with lateral channel bracing. Extend bracing minimum 24 inches past each end of openings.
- E. Laterally brace entire suspension system.

3.07 ACOUSTICAL ACCESSORIES INSTALLATION

- A. Install resilient channels at maximum 24 inches on center. Locate joints over framing members.
- B. Place acoustical insulation in partitions tight within spaces, around cut openings, behind and around electrical and mechanical items within or behind partitions, and tight to items passing through partitions.
- C. Install acoustical sealant at wall perimeter of designated partitions as follows:
 - 1. Metal Framing: Two beads at contact area at intersecting walls, floors and ceilings.
 - 2. Base Layer Gypsum Board: One bead.
 - 3. Seal penetrations of partitions by conduit, pipe, ductwork, rough-in boxes, and access door frames.

3.08 GYPSUM BOARD INSTALLATION

- A. Install gypsum board in accordance with GA 201, GA 216, GA-600 and U.S.G. "Gypsum Construction Handbook".
- B. Erect interior board horizontally if space is small so as to avoid end butt joint; otherwise install gypsum board vertically, with ends and edges occurring over firm bearing. Stagger end joints to occur at different locations on opposite sides of wall. Apply board to suspended ceilings with long dimension at right angles to framing.
- C. Erect exterior gypsum sheathing horizontally, with edges butted tight and ends occurring over firm bearing. Abut boards without forcing. Neatly fit ends and edges of boards and make cuts and penetrations so that paper facing and gypsum core are not damaged.
- D. Use screws when fastening gypsum board to metal furring or framing and nails to wood studding. Stagger fasteners opposite each other on adjacent ends and edges. Space fasteners as recommended in U.S.G., "Gypsum Construction Handbook". Do not attach gypsum board to top track on partitions extending from floor to structure above.
- E. Treat cut edges and holes in moisture resistant gypsum board and exterior gypsum ceiling board with sealant.
- F. Place control joints at changes in back-up material, at maximum 20'-0" off center in exterior walls, and at maximum 30'- 0" off center at interior partitions. In ceilings, install at maximum 30'-0" off center each way. Provide fire resistant protections behind control joints in fire rated assemblies.
- G. Place corner beads at external corners. Use longest practical length. Place edge trim where gypsum board abuts dissimilar materials.
- H. On fire rated assemblies, seal penetrations and make air-tight. Refer to Section 07840 for firestopping requirements and materials.
- I. Thicken partitions to eliminate wall surface jogs for the full length of the wall within a room to conceal structural members, pipes, panels, specialty items, and accessories.
- J. Coordinate door and other frame thicknesses as required.

3.09 JOINT TREATMENT

- A. Tape, fill, and sand exposed joints, edges, and corners to produce surface ready to receive finishes. The intent is to provide the highest quality of joint treatment work consistent with commercial construction. Leave surfaces smooth, uniform, and free of fins, depressions, ridges, cracks, and other imperfections.
- B. Feather coats onto adjoining surfaces so that camber is maximum 1/32 inch.

- C. Levels of Finish:
 - 1. Comply with GA-214; italicized commentary is excluded; replace words "may" and "should" with "shall."
 - 2. Locations to receive Level 4 finish: Areas to be painted.
 - 3. Locations to receive Level 3 finish: Areas to receive moisture resistant gypsum board used as a tile substrate.
 - 4. Locations to receive Level 2 finish: Fire-rated, sound-rated, and smoke-rated assemblies in ceiling plenums and concealed areas.
 - 5. Locations to receive Level 1 finish: Non-fire-rated, non-sound-rated, and non-smoke-rated assemblies in ceiling plenums and concealed areas.

3.10 TOLERANCES

A. Maximum Variation from True Flatness: 1/8 inch in 10 feet in any direction.

END OF SECTION

SECTION 09511 - SUSPENDED ACOUSTICAL CEILINGS

PART 1 - GENERAL

- 1.01 Work Included
 - A. Suspended metal grid ceiling system.
 - B. Acoustical tile panels.

1.02 Related Work

- A. Air diffusion devices in ceiling system.
- B. Light fixtures in ceiling system.

1.03 References

- A. ASTM C635 Metal Suspension Systems for Acoustical Tile and Lay-in Panel Ceilings.
- B. ASTM C636 Installation of Metal Ceiling Suspension Systems for Acoustical Tile and Lay-in Panels.
- C. UL Underwriter's Laboratories System Ratings.
- 1.04 Quality Assurance
 - A. Manufacturer: Company specializing in the manufacture of ceiling suspension system and ceiling tile panels, three years minimum experience.
 - B. Installer: Company shall have experience installing the approved manufacturer.
- 1.05 Regulatory Requirements
 - A. Conform to applicable code for fire rated assembly where required.

1.06 Submittals

- A. Submit shop drawings and product data for review.
- B. Indicate on shop drawings, grid layout and related dimensioning, junctions with other work or ceiling finishes, interrelation of mechanical and electrical items related to system.
- C. Provide product data on metal grid system components, and acoustic units.
- D. Submit samples to Owner and Architect for review.
- E. Submit manufacturer's installation instruction.

- 1.07 Environmental Requirements
 - A. Maintain uniform temperature of minimum 60 degree F (16 degrees C), and humidity of 20 to 40 percent prior to, during, and after installation.
- 1.08 Sequencing/Scheduling
 - A. Do not install acoustical ceilings until building is enclosed, sufficient heat is provided, dust generating activities have terminated and overhead work is completed, tested, and approved.
 - B. Schedule installation of acoustic units after interior work is dry.
- 1.09 Extra Stock
 - A. Provide one carton [of each type used] extra tile panels to Owner.

PART 2 - PRODUCTS

- 2.01 Manufacturer
 - A. Items specified by Armstrong. Other manufacturers may be submitted for review and Architect's approval 10 days prior to bidding. All Acoustic Units and Suspension Systems shall be from the same manufacturer and shall be Class A fire rated.
- 2.02 Suspension System
 - A. Styles: See Finish Schedule on Architectural drawings for location of each specified style.
 1. Armstrong "15/16" Prelude XL" exposed tee system for square lay-in units color White (WH)
 - B. Support Channels and Hangers: Size and type to suit application, to rigidly secure acoustic ceiling system including integral mechanical electrical components with maximum deflection of 1/360.
- 2.03 Acoustic Units
 - A. Styles: See Finish Schedule on Architectural drawings for location of each specified style.
 - 1. Armstrong "Ultima High NRC" #1940, 24"x24"x7/8", square lay-in, color White.
 - 2. Armstrong "Optima" #3152, 24"x24"x1", square lay-in, color White.
 - 3. Armstrong "Fine Fissured" #1728, 24"x24"x5/8", square lay-in, color White.

PART 3 - EXECUTION

- 3.01 Inspection
 - A. Verify that existing conditions are ready to receive work.
 - B. Verify that layout of hangers will not interfere with other work.

C. Beginning of installation means acceptance of existing conditions.

3.02 Installation

- A. Install system in accordance with ASTM C636 manufacturer's instructions and as supplemented in this Section.
- B. Install system capable of supporting imposed loads to a deflection of 1/360 maximum.
- C. Install after major above ceiling work is complete. Coordinate the location of hangers with other work.
- D. Supply hangers or inserts for installation of mechanical and electrical if metal deck is not supplied with hanger tabs, coordinate the installation of hanger clips during steel deck erection. Provide additional hangers and inserts as required.
- E. Hang system independent of walls, columns, ducts, pipes and conduit. Where carrying members are spliced, avoid visible displacement of face plane of adjacent members.
- F. Where ducts are other equipment prevent the regular spacing of hangers, reinforce the nearest affected hangers (and related carrying channels) to span the extra distance.
- G. Center system on room axis leaving equal border units, unless otherwise directed by reflected ceiling plan.
- H. Do not support components on main runners or cross runners if weight causes total dead load to exceed deflection capability.
- I. Do not eccentrically load systems, or produce rotation of runners.
- J. Install edge molding at intersection of ceiling and vertical surfaces, using longest practical lengths. Miter corners. Provide edge moldings at junctions with other interruptions.
- K. Form expansion joints as required.
- L. Fit acoustic units in place, free from damaged edges or other defects detrimental to appearance and function.
- M. Install acoustic units level, in uniform plane, and free from twist, warp and dents.

3.03 Tolerances

A. Variation from flat and level surface: 1/8 inch in 10 ft.

End of Section

SECTION 09650 - RESILIENT FLOORING

PART 1 - GENERAL

1.01 SUMMARY

A. Extent of resilient flooring and accessories as shown on Drawings and Specified herein.

Work includes:

- 1. Vinyl Composition Tile
- 2. Static Dissipative Vinyl tile
- 3. Luxury Vinyl Plank/Tile
- 4. Vinyl Stair/Tread System
- 5. Contoured Resilient Wall Base
- 6. Vinyl Cove Base
- 7. Resilient Edge Strips

1.02 SUBMITTALS

- A. Product Data: Submit manufacturer's technical data and installation instructions for resilient flooring and accessories in accordance with Section 01300.
- B. Samples: Submit, for verification purposes, samples of each type, color and pattern of resilient flooring and accessory required, indicating full range of color/pattern variation.
- C. Maintenance Instructions: Submit copies of manufacturer's recommended maintenance practices for each type of resilient flooring required to Owner.

1.03 QUALITY ASSURANCE

- A. Comply with governing codes and regulations. Provide products of standard quality of manufacturers as specified. Use experienced installers. Deliver, handle, and store materials in accordance with manufacturer's instructions.
- B. Provide materials and adhesives which do not contain asbestos.

PART 2 - PRODUCTS

2.01 MATERIALS

Refer to Finish Schedule on Drawings for styles and colors of specified materials.

A. Luxury Vinyl Plank Tile shall be Patcraft Commercial Flooring "Crossover - 1439-V" color 00720 Smokey Taupe, glue-down resilient planks, size 7"x48"x.197", 20.0 MIL, ASTM F1700 Class III printed film vinyl plank, Type B embossed, meeting ASTM F970, ASTM F1914 ASTM F925, ASTM E648-Class I, ASTM E662, ASTM D2047.

- B. Rubber Flooring shall be Rubberflex Flooring "Impact Gold Series", 1/4" (6mm) thickness, 4'x50' rolls.
 Supplier: Langhorn Flooring Concepts, Inc. 300 Union Grove Rd SE Calhoun, Ga 30701 (706)609-3331 www.langhornfci.com
- C. Vinyl Cove Base, 4" high x ¹/₈" gauge set-on type, as manufactured by Johnsonite or approved equal, and furnished in 120' long rolls meeting the requirements of ASTM F1861, Type TV, Group 1 and ASTM E-648/NFPA 253, Class 1.
- D. Contoured resilient Wall Base shall be Johnsonite "Millwork", solid color throughout, meeting dimensional and performance requirements of ASTM F-1861, Type TP, Group 1 Standard Specification for Resilient Wall Base. Inside and outside corners shall be miter cut and fitted in the field. Profile, height and color as indicated on Finish Schedule.
- E. Resilient Edge Strips: ADA compliant, homogeneous vinyl or rubber transition strips as required where change of flooring types occur. Color to match flooring or as selected by Architect from standard colors available.
- F. Adhesives: Waterproof, stabilized type as recommended by flooring manufacturer to suit material and substrate conditions.
- G. Concrete Slab Primer: Non-staining type as recommended by flooring manufacturer.
- H. Leveling Compound: As recommended by flooring manufacturer.

PART 3 - EXECUTION

3.01 INSPECTION

- A. Make a thorough examination of surfaces to receive resilient flooring. If surfaces are defective and will not permit a proper finished installation, immediately notify the Architect in writing, or assume responsibility for and rectify any resulting unsatisfactory condition.
- B. Inspect floor for holes, cracks and smoothness. Test for dryness. Do not proceed with laying until subfloors are dry and smooth, holes and cracks filled.

3.02 PROJECT CONDITIONS

- A. Substrate Conditions: The installer shall verify in writing to the Owner, a minimum of 30 days prior to scheduled resilient flooring installation, the following substrate conditions:
 - 1. Moisture: Initial emission rate, as tested with a calcium chloride test kit.
 - 2. Alkalinity: pH range of 6-8. Must not exceed pH of 10.

- B. After application (by others) of the concrete sealer, the installer shall perform a second calcium chloride test. These second test results will be compared with the previous results. Final results shall not exceed resilient flooring manufacturer's allowable emission rate.
- C. Maintain minimum temperature of 68°F (20°C) in spaces to receive resilient flooring for at least 72 hours prior to installation, during installation and for not less than 48 hours after installation. Subsequently, maintain minimum temperature of 68°F (20°C) in areas where work is completed.
- D. Install resilient flooring and accessories after they have the same temperature as the space and after other finishing operations, including painting, have been completed. Moisture content and alkalinity level of concrete slabs, as well as environmental conditions, must be within limits recommended by manufacturer of products being installed.

3.03 PREPARATION

- A. Broom clean or vacuum surfaces to be covered, and inspect subfloor. Start of flooring installation indicates acceptance of subfloor conditions and full responsibility for completed work.
- B. Use leveling compound as recommended by flooring manufacturer for filling small cracks, holes and depressions in subfloor.
- C. Perform moisture tests on concrete slabs to determine that concrete surfaces are sufficiently cured dry as well as to ascertain presence of curing compounds, and ready to receive flooring.
- D. Apply concrete slab primer, if recommended by flooring manufacturer, prior to application of adhesive. Apply in compliance with manufacturer's directions.

3.04 INSTALLATION

- A. Place flooring with adhesive cement in strict compliance with manufacturer's recommendations. Butt tightly to vertical surfaces, thresholds, nosings, and edgings. Scribe around obstructions to produce neat joints, laid tight, even, and straight. Extend flooring into toe spaces, door reveals, and into closet and similar openings.
- B. Maintain reference markers, holes, or openings that are in place or plainly marked for future cutting by repeating on finish flooring as marked on subfloor. Use chalk or other nonpermanent-marking device.
- C. Install flooring on covers for telephone and electrical ducts, and other such items as occur within finished floor areas.
- D. Maintain overall continuity of color and pattern with pieces of flooring installed in these covers. Tightly cement edges to perimeter of floor around covers and to covers.

- E. Tightly cement flooring to subbase without open cracks, voids, raising and puckering at joints, telegraphing of adhesive spreader marks, or other surface imperfections. Hand roll flooring at perimeter for each covered area to assure adhesion.
- F. Tile Floors
 - 1. Lay tile from center marks established with principal walls, discounting minor offsets, so that tile at opposite edges of room are of equal width. Adjust as necessary to avoid use of cut widths less than ¹/₂ tile at room perimeters.
 - a. Lay tile square to room axis, unless otherwise shown.
 - b. Lay tile in "checkerboard" fashion with grain reversed in adjacent tiles.
 - c. Follow Floor Tile Patterns as indicated on Drawings where required.
 - 2. Match tile for color and pattern by using tile from cartons in same sequence as manufactured and packaged if so numbered. Cut tile neatly around all fixtures. Broken, cracked, chipped or deformed tiles are not acceptable.
 - 3. Adhere tile flooring to substrates using full spread of adhesive applied in accordance with flooring manufacturer's recommendations.
- G. Accessories: Apply resilient base to walls, columns, pilasters, casework and other permanent fixtures in rooms or areas where base is required. Install base in lengths as long as practicable, with preformed corner units or fabricated from base materials with mitered or coped inside corners. Tightly bond base to backing throughout length of each piece, with continuous contact at horizontal and vertical surfaces.
 - 1. On masonry surfaces or other similar irregular surfaces, fill voids along top edge of resilient wall base with manufacturer's recommended adhesive filler material.
 - 2. Place resilient edge strips tightly butted to flooring and secure with adhesive. Install edging strips at edges of flooring which would otherwise be exposed.
 - 3. Apply butt type metal edge of flooring where shown on drawings, and prior to resilient flooring. Secure units to substrate with countersunk stainless steel anchors, complying with manufacturer's recommendation.

3.05 CLEANING AND PROTECTION

A. Immediately upon completion of the resilient flooring remove any excess adhesive or other surface blemishes, using neutral type cleaners as recommended by flooring manufacturer.

- 1. Do not wash or machine scrub linoleum for at least 3-5 days after installation.
- 2. Do not strip factory finish from linoleum sheet flooring per Manufacturer recommendations.
- B. Protect installed flooring with heavy Kraft paper or other covering.
- C. Finishing: After completion of project and just prior to final inspection of work, thoroughly clean all floors and accessories.
 - 1. Apply waxes to linoleum sheet flooring as recommended by the Manufacturer and buff coats minimum prior to Owner's occupancy and/or final completion of the project.

3.06 EXTRA STOCK

A. Provide the Owner with the following: one (1) unopened carton of each tile selection specified on this project.

End of Section

SECTION 09900 - PAINTING

PART 1 - GENERAL

1.01 DESCRIPTION OF WORK

- A. Extent of painting work is shown on drawings and schedules, and as herein specified.
- B. The work includes painting and finishing of interior and exterior exposed items and surfaces throughout Project, except as otherwise indicated.
 - 1. Surface preparation, priming, and coats of paint specified are in addition to shoppriming and surface treatment specified under other sections of work.
- C. "Paint" as used herein means all coating systems materials, including primers, emulsions, enamels, stains, sealers and fillers, and other applied materials whether used as prime, intermediate, or finish coats.
- D. Surfaces to be Painted: Except where natural finish of material is specifically noted as a surface not to be painted, paint exposed surfaces whether or not colors as designated in "schedules". Where items or surfaces are not specifically mentioned, paint the same as similar adjacent materials or areas. If color or finish is not designated, Architect will select these from standard colors or finishes available.
- E. Do not paint over any code-required labels such as Underwriters Laboratories and Factory Mutual, or any equipment identification, performance rating, name, or nomenclature plates.

1.02 QUALITY ASSURANCE

- A. Single Source Responsibility: Provide primers and other undercoat paint produced by same manufacturer as finish coats. Use only thinners approved by paint manufacturer on published product data pages, and use only within recommended limits.
- B. Coordination of Work: Review other sections of these specifications in which prime paints are to be provided to ensure compatibility of total coatings system for various substrates. Upon request from other trades, furnish information or characteristics of finish materials provided for use, to ensure compatible prime coats are used. Test existing surfaces scheduled to receive new paint or epoxy coating to insure compatibility of new primer and paint system.
- C. Employ only experienced and competent mechanics.
- D. Field Quality Control: Prepare and finish a sample area or room as directed. Finish in accordance with specification requirements for Architect's approval of materials, color and workmanship. Approved area or room shall serve as Project Standard.

1.03 SUBMITTALS

- A. Product Data: Submit manufacturer's technical information including paint label analysis and application instructions for each material proposed for use.
- B. Provide Owner at completion of job, one gallon of paint of each color selected. Provide original unopened labeled containers with color sample and list of room numbers where used.

1.04 DELIVERY AND STORAGE

- A. Deliver materials to job site in original, new, and unopened packages and containers bearing manufacturer's name and label, and following information:
 - 1. Name or title of material.
 - 2. Federal Specification number, if applicable.
 - 3. Manufacturer's stock number and date of manufacturer.
 - 4. Manufacturer's name.
 - 5. Contents by volume, for major pigment and vehicle constituents.
 - 6. Thinning instructions.
 - 7. Application instructions.
 - 8. Color name and number.
- B. Store materials not in actual use in tightly covered containers. Maintain containers used in storage of paint in a clean condition, free of foreign materials and residue.
 - 1. Protect from freezing where necessary. Keep storage area neat and orderly. Remove oily rags and waste daily. Take all precautions to ensure that workmen and work areas are adequately protected from fire hazards and health hazards resulting from handling, mixing, and application of paints.

1.05 JOB CONDITIONS

- A. Coordinate with other trades to insure adequate ventilation and dust-free environment during application and drying of paint.
- B. Maintain temperature and humidity within Manufacturer's recommended tolerances.
- C. Do not apply paint in snow, rain, fog, or mist; or when humidity exceeds 85%; or to damp or wet surfaces; unless otherwise permitted by paint manufacturer's printed instructions.
 - 1. Painting may be continued during inclement weather if areas and surfaces to be painted are enclosed and heated within temperature limits specified by paint manufacturer during application and drying periods.
- D. Painting Contractor shall provide stand mounted, high intensity, portable lighting for their use during painting to provide adequate illumination.

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

- A. Manufacturer: Subject to compliance with requirements, provide paint products of one of the following or an approved equal:
 - 1. Glidden Professional
 - 2. Porter Paints
 - 3. PPG
 - 4. Benjamin Moore and Co.
 - 5. The Sherwin-Williams Company

2.02 MATERIALS

- A. Material Quality: Provide best quality grade of various types of coatings as regularly manufactured by acceptable paint materials manufacturers. Materials not displaying manufacturer's identification as a standard, best-grade product will not be acceptable.
 - 1. Proprietary names used to designate colors or materials are not intended to imply that products of named manufacturers are required to exclusion of equivalent products of other manufacturers.

PART 3 - EXECUTION

- 3.01 INSPECTION
 - A. Applicator must examine areas and conditions under which painting work is to be applied and notify Contractor in writing of conditions detrimental to proper and timely completion of work. Do not proceed with work until unsatisfactory conditions have been corrected in a manner acceptable to Applicator.
 - B. Starting of painting work will be construed as Applicator's acceptance of surfaces and conditions within any particular area.
 - C. Do not paint over dirt, rust, scale, grease, moisture, scuffed surfaces, or conditions otherwise detrimental to formation of a durable paint film.

3.02 SURFACE PREPARATION

- A. General: Perform preparation and cleaning procedures in accordance with paint manufacturer's instructions and as herein specified, for each particular substrate condition.
 - 1. Provide barrier coats over incompatible primers or remove and re-prime as required. Notify Architect in writing of any anticipated problems in using the specified coating systems with substrates primed by others.
 - 2. Remove hardware, hardware accessories, machined surfaces, plates, lighting fixtures, and similar items in place and not to be finish-painted, or provide surface-applied protection prior to surface preparation and painting operations. Remove, if necessary, for complete painting of items and adjacent surfaces. Following completion of painting of each space or area, reinstall removed items.

- 3. Clean surfaces to be painted before applying paint or surface treatments. Remove oil and grease in accordance with SSPC SP-1, prior to mechanical cleaning. Program cleaning and painting so that contaminants from cleaning process will not fall onto wet, newly-painted surfaces.
- B. Cementitious Materials: Prepare cementitious surfaces of concrete, concrete block, to be painted by removing efflorescence, chalk, dust, dirt, grease, oils in accordance with ASTM D 4258/D 4259/D 4261 (CMV).
 - 1. Determine alkalinity and moisture content of surfaces to be painted by performing ASTM D 4262. If surfaces are found to be sufficiently alkaline to cause blistering and burning of finish paint, correct this condition before application of paint. Do not paint over surfaces where moisture content exceeds that permitted in manufacturer's printed directions.
- C. Wood: Clean wood surfaces to be painted of dirt, oil, or other foreign substances with scrapers, mineral spirits, and sandpaper, as required. Sandpaper smooth those finished surfaces exposed to view, and dust off. Scrape and clean small, dry, seasoned knots and apply a thin coat of white shellac or other recommended knot sealer, before application of priming coat. After priming, fill holes and imperfections in finish surfaces with putty or plastic wood-filler. Sandpaper smooth when dried.
 - 1. Prime, stain, or seal wood required to be job-painted immediately upon delivery to job. Prime edges, ends, faces, undersides, and backsides of such wood, including cabinets, counters, cases, paneling.
 - 2. When transparent finish is required, use spar varnish for backpriming.
 - 3. Seal tops, bottoms, and cut-outs of unprimed wood doors with a heavy coat of varnish or equivalent sealer immediately upon delivery to job.
- D. Ferrous Metals: Clean ferrous surfaces which are not galvanized or shop-coated of oil, grease, dirt, loose mill scale, and other foreign substances by solvent or mechanical cleaning in accordance with SSPC SP-1.
 - 1. Touch up shop-applied prime coats wherever damaged or bare, where required by other sections of these specifications.
 - a. Clean and touch-up with same type shop primer.
- E. Galvanized Surfaces: Clean free of oil and surface contaminants with non-petroleum based solvent such as Great Lakes Laboratories "Clean N' Etch", TSP, or an approved equal.

3.03 MATERIALS PREPARATION

- A. Mix and prepare painting materials in accordance with manufacturer's directions.
- B. Maintain containers used in mixing and application of paint in a clean condition, free of foreign materials and residue.

C. Stir materials before application to produce a mixture of uniform density, and stir as required during application. Do not stir surface film into material. Remove film and, if necessary, strain material before using.

3.04 APPLICATION

- A. General: Apply paint in accordance with manufacturer's directions. Use applicators and techniques best suited for substrate and type of material being applied.
 - 1. Paint colors, surface treatments, and finishes are indicated in "Schedules" of the Contract Documents.
 - 2. Provide finish coats which are compatible with prime paints used.
 - 3. Apply additional coats when undercoats, stains, or other conditions show through final coat of paint, until paint film is of uniform finish, color, and appearance. Give special attention to insure that surfaces, including edges, corners, crevices, welds, and exposed fasteners receive a dry film thickness equivalent to that of flat surfaces. Dry film thickness will be measured according to SSPC PA-2.
 - 4. Paint surfaces behind movable equipment and furniture same as similar exposed surfaces. Paint surfaces behind permanently fixed equipment or furniture with prime coat only before final installation of equipment.
 - 5. Paint interior surfaces of ducts, where visible through registers or grilles, with a flat non-specular black paint such as Sherwin-Williams: PM 400 Black, B30 or B400, Glidden Flat Black, or an approved equal.
 - 6. Paint back sides of access panels, and removable or hinged covers to match exposed surfaces.
 - 7. Finish exterior doors on tops, bottoms, and side edges same as exterior faces unless otherwise indicated.
 - 8. Sand lightly between each succeeding enamel or varnish coat.
 - 9. Omit first coat (primer) on metal surfaces which have been shop-primed and touch-up painted unless otherwise indicated.
- B. Scheduling Painting: Apply first-coat material to surfaces that have been cleaned, pretreated, or otherwise prepared for painting as soon as practicable after preparation and before subsequent surface deterioration.
 - 1. Allow sufficient time between successive coatings to permit proper drying. Do not recoat until paint has dried to where it feels firm, does not deform or feel sticky under moderate thumb pressure, and application of another coat of paint does not cause lifting or loss of adhesion of the undercoat.

- C. Minimum Coating Thickness: Apply materials at not less than manufacturer's recommended spreading rate to establish a total dry film thickness as indicated or, if not indicated, as recommended by coating manufacturer. Dry film thickness will be measured according to SSPC PA-2.
- D. Mechanical and Electrical Work: Painting of mechanical and electrical work is limited to those items exposed in mechanical equipment rooms and in occupied spaces, and exposed exterior work that is not factory finish painted.
- E. Prime Coats: Apply prime coat of material which is required to be painted or finished, and which has not been prime coated by others.
 - 1. Re-coat primed and sealed surfaces where there is evidence of suction spots or unsealed areas in first coat, to assure a finish coat with no burn-through or other defects due to insufficient sealing.
- F. Pigmented (Opaque) Finishes: Completely cover to provide an opaque, smooth surface of uniform finish, color, appearance, and coverage. Cloudiness, spotting, holidays, laps, brush marks, runs, sags, ropiness, or other surface imperfections will not be acceptable.
- G. Transparent (Clear) Finishes: Use multiple coats to produce glass-smooth surface film of even luster. Provide a finish free of laps, cloudiness, color irregularity, runs, brush marks, orange peel, nail holes, or other surface imperfections.
 - 1. Provide satin finish for final coats unless otherwise indicated.
- H. Completed Work: Match approved samples for color, texture and coverage. Remove, refinish or repaint work not in compliance with specified requirements.

3.05 CLEAN-UP AND PROTECTION

- A. Clean-Up: During progress of work, remove from site discarded paint materials, rubbish, cans, and rags at end of each work day.
 - 1. Upon completion of painting work, clean window glass and other paint-spattered surfaces. Remove spattered paint by proper methods of washing and scraping, using care not to scratch or otherwise damage finished surfaces.
- B. Protection: Protect work of other trades, whether to be painted or not, against damage by painting and finishing work. Correct any damage by cleaning, repairing or replacing, and repainting, as acceptable to Architect.
 - 1. Provide "Wet Paint" signs as required to protect newly-painted finishes. Remove temporary protective wrappings provided by others for protection of their work, after completion of painting operations.

2. At the completion of work of other trades, touch up and restore all damaged or defaced painted surfaces.

3.06 ADJUST AND CLEAN

- A. Clean surfaces of spills, splatters, drips and stains from painting application.
- B. Replace and adjust finish hardware, accessories, fixtures and similar items removed from work.
- C. Touch-up damaged paint surface prior to acceptance of building by the Owner. Mix or thin touch-up paint as recommended by the Manufacturer and blend into existing paint.

3.07 PAINT SYSTEMS

- A. Paints listed are those of Glidden Professional unless noted otherwise, Sherwin-Williams, or an approved equal.
 Painting subcontractor wishing to use other products must submit their "or equal" for review during the bidding process. Please note that *colors have been selected*.
- B. Exterior Coating Systems (Coating systems by manufacturers listed in part 2.01.A, or approved equal, shall be standard as systems specified below):
 - 1. Ferrous Metals
 - Primer: 4160-1000 Devguard Multi-Purpose Tank & Structural Primer 2-2.5 DFT
 - 1st Coat: 4160-1000 Devguard Multi-Purpose Tank & Structural Primer @ 2.0-2.5 mils dft
 - 2nd Coat: 4308-0100 Devguard Alkyd Industrial Enamel @ 2.0-2.5 mils dft per coat
 - 3rd Coat: 4308-0100 Devguard Alkyd Industrial Enamel @ 2.0-2.5 mils dft per coat
 - a. Typical Applications: Overhead doors and frames, steel doors and frames, piping, pipe railing, miscellaneous metals.
 - 2. Zinc Coated Metals
 - Primer: 4160-1000 Devguard Multi-Purpose Tank & Structural Primer @ 2.0-2.5 mils dft
 - 1st Coat: 4308-0100 Devguard Alkyd Industrial Enamel @ 2.0-2.5 mils dft per coat
 - 2nd Coat: 4308-0100 Devguard Alkyd Industrial Enamel @ 2.0-2.5 mils dft per coat
 - 3. Concrete Block

Provide clean and dulled surface for application of new paint as recommended by paint manufacturer.

- 1st Coat: 4000-1000 Bloxfil 4000 Heavy Duty Block Filler @ 7.0-14.5 mils dft
- 2nd Coat: 4206-0100 Devflex Interior/Exterior Waterborne Acrylic Semi-Gloss @ 1.5-2.0 mils dft
- 3rd Coat: 4206-0100 Devflex Interior/Exterior Waterborne Acrylic Semi-Gloss @ 1.5-2.0 mils dft

- C. Interior Coating Systems (Coating systems by manufacturers listed in part 2.01.A, or approved equal, shall be standard as systems specified below):
 - 1. Interior Ferrous Metal: Door Frames, Miscellaneous Metals: 2 coats of an all purpose industrial enamel, over a fast drying, rust inhibitive alkyd enamel.

 $1^{\rm st}$ Coat: 4160-1000 Dev
guard Multi-Purpose Tank & Structural Primer @ 2.0-2.5 mils dft

2nd Coat: 4308-0100 Devguard Alkyd Industrial Enamel @ 2.0-2.5 mils dft per coat 3rd Coat: 4308-0100 Devguard Alkyd Industrial Enamel @ 2.0-2.5 mils dft per coat

2. Interior Gypsum Drywall (semi-gloss): 2 coats of an interior waterborne acrylic semigloss, durable and non-yellowing, over an interior vinyl acrylic latex wall primer.

1st Coat: 1000-1200 Prep & Prime Interior Latex Wall Primer Sealer @ 1.2-1.5 mils dft

2nd Coat: 1406-0100 Dulux Pro Premium Semi-Gloss Interior Enamel @ 1.5 mils dft 3rd Coat: 1406-0100 Dulux Pro Premium Semi-Gloss Interior Enamel @ 1.5 mils dft

- 3. Interior Gypsum Drywall (flat): 2 coats of an interior latex flat, durable and nonyellowing, over an interior latex wall primer.
 - Primer: 1000-1200 Prep & Prime Interior Latex Wall Primer Sealer @ 1.2-1.5 mils dft
 - 1st Coat: 1200-0100 Dulux Pro Premium Interior Flat Latex Finish @ 1.4-2.0 mils dft
 - 2nd Coat: 1200-0100 Dulux Pro Premium Interior Flat Latex Finish @ 1.4-2.0 mils dft
- 4. Interior Gypsum Drywall (eggshell): 2 coats of an interior latex eggshell, durable and non-yellowing, over an interior latex wall primer.
 - Primer: 1000-1200 Prep & Prime Interior Latex Wall Primer Sealer @ 1.2-1.5 mils dft

1stCoat: 1402-0100 Dulux Pro Premium Eggshell Enamel Finish @ 1.5 mils dft 2ndCoat: 1402-0100 Dulux Pro Premium Eggshell Enamel Finish @ 1.5 mils dft

- 5. Galvanized Metal: 2 coats of an interior waterborne acrylic semi-gloss, durable and non yellowing
 - 1st Coat: 4020-0100 Deflex DTM Flat Interior/Exterior Primer & Finish @ 2.2-3.5 mils dft
 - 2nd Coat: 4216-0100 Devflex HP Waterborne Acrylic Semi-Gloss @ 1.5-4.0 mils dft
- 6. Aluminum: 2 coats of an interior waterborne acrylic semi-gloss, durable and non yellowing.
 - 1st Coat: 4216-0100 Devflex HP Waterborne Acrylic Semi-Gloss @ 1.5-4.0 mils dft
 - 2nd Coat: 4216-0100 Devflex HP Waterborne Acrylic Semi-Gloss @ 1.5-4.0 mils dft

7. Wood-Closed Grain: Stained: 2 coats of a satin waterborne polyurethane over an interior oil based stain.

1st Coat: 1700-0000 WoodPride Interior Oil Wood Stain 2nd Coat: 1802-0000 WoodPride Interior Aquacrylic Satin Varnish 3rd Coat: 1802-0000 WoodPride Interior Aquacrylic Satin Varnish

Concrete Floors: 2 coats of waterbased coating, clear finish – #3214 Groundworks waterbased concrete sealer by Glidden Professional.
 Note: Concrete must cure 45 days. Smooth-troweled concrete must be etched with muriatic acid prior to finishing. Do not apply to areas scheduled to receive flooring.

END OF SECTION

SECTION 10155 - TOILET COMPARTMENTS

PART 1 - GENERAL

1.01 WORK INCLUDED

- A. Metal partitions for toilets.
- B. Urinal Screens
- C. Attachment hardware.

1.02 RELATED WORK

A. Section 10800 - Toilet and Bath Accessories: Toilet accessories.

1.03 REFERENCES

- A. ASTM A424 Steel Sheets for Porcelain Enameling.
- B. FS RR-P-1352 Partitions, Metal Toilet, Complete.
- C. ASTM A526 Steel Sheet, Zinc-Coated (Galvanized) by the Hot-Dip Process, Commercial Quality.
- D. ASTM A167 Stainless and Heat Resisting Chromium-Nickel Steel, Plate, Sheet and Strip.

1.04 SUBMITTALS

- A. Submit shop drawings and product data, along with manufacturer's descriptive literature, installation instructions and appropriate color selection charts.
- B. Clearly indicate partition layouts, swing of doors, elevations, anchorage and mounting details, panel construction, components hardware, finishes and all relevant dimensions.

PART 2 - PRODUCTS

2.01 METAL TOILET COMPARTMENTS

- A. Acceptable Manufacturers
 - 1. Flush-Metal Partition Corp.
 - 2. Metpar
 - 3. Sanymetal
 - 4. Approved Equal
- B. Type
 - 1. Provide floor-mounted, overhead-braced toilet partitions with anti-grip headrail.
 - 2. Provide pilaster-type floor-supported urinal screens.
 - 3. Provide end stalls to meet ADA requirements.

C. Materials

- 1. 1" thick, of two sheets galvanized steel, honeycomb core, welded edges and corners.
- 2. Finish: Baked enamel. Color to be selected by Architect.
- 3. Attachments, Screws and Bolts: Stainless steel, tamper-proof type, heavy duty extruded aluminum brackets.
- 4. Hardware: Chrome-plated non-ferrous cast pivot hinges, gravity type, adjustable for door closing positioning; nylon bearings; concealed, thumb-turn door latch; door strike and keeper with rubber bumper; chrome plated coat hook and bumper.
- D. Fabrication
 - 1. Fabricate partitions in accordance with FS RR-P-1352
 - 2. Doors and Panels: 1" or 1-1/4" x 58" high, 24" wide doors at standard stalls, 34" wide doors at handicap stalls.
 - 3. Provide internal reinforcement where necessary for attachment of hardware and fittings. Mark locations of reinforcement for partition-mounted washroom accessories.

PART 3 - EXECUTION

3.01 PREPARATION

- A. Examine site conditions to which work is to be applied. Report discrepancies to Architect/ Engineer in writing.
- B. Take site dimensions affecting this work.
- C. Ensure correct spacing of plumbing fixtures.
- D. Ensure correct location or built-in framing, anchorage, and bracing, where required.

3.02 INSTALLATION

- A. Install partitions secure, plumb, level, and square.
- B. Leave 1/2 inch space between wall and panels and between wall and end plasters.
- C. Attach panel brackets securely to walls using anchor devices as required by manufacturer.
- D. Attach panels and pilasters to bracket with through sleeve tamperproof bolts and nuts.
- E. Anchor urinal screen panels to walls with two panel brackets and vertical upright to floor.
- F. Provide for adjustment of floor variations.

- G. Equip each door with hinges, one door latch, and one coat hook and bumper.
- H. Install door strike keeper and door bumper on each pilaster in alignment with door latch.
- I. Adjust and align hardware to uniform clearance at vertical edges of doors not exceeding $\frac{1}{4}$ ".
- J. Adjust hinges to locate doors in partial open position when unlatched, except that out-swing doors shall return to closed position.

3.03 CLEANING

- A. Damaged, scratched or marred defective materials will be rejected, and shall be replaced with new materials.
- B. Remove protective maskings. Clean surfaces free of oil and imperfections.

End of Section

SECTION 10426 - IDENTIFYING DEVICES

PART 1 - GENERAL

1.01 DESCRIPTION

- A. Furnish and install all signage and identifying devices and handicap parking signs where shown or scheduled on the Drawings and specified herein.
- B. This section includes the installation of such devices in locations as indicated on plans, or where not shown, as required to meet requirements of the Americans with Disability Act of 1990 (ADA).

1.02 SUBMITTALS

- B. Manufacturer's Data: Submit manufacturer's descriptive literature and specifications, including color samples of material for selection, as applicable for approval.
- B. Submit shop drawings listing sign styles, lettering and locations, and overall dimensions of each sign.

1.03 REFERENCES

- A. American National Standards Institute (ANSI): A117.1 1992 Accessible Signage Standards (4.28 Signage)
- B. American Society for Testing and Materials (ASTM).
- C. Americans with Disabilities Act Accessibility Guideline (ADAAG): 4.30 Signage
- D. California Title 24 Accessible Signage Standards (3105)

1.04 DELIVERY, STORAGE & HANDLING

- A. Deliver components correctly packaged to prevent damage.
- B. Store in secure areas, out of weather and protected from work of other trades.

1.05 WARRANTY

A. Provide Manufacturer's standard one year limited warranty covering manufacturing defects.

PART 2 - PRODUCTS

2.01 HANDICAP PARKING SIGNS

A. Furnished for installation under work of Section 02700, manufacturer's standard aluminum sign plate for identification of handicapped parking spaces. Plates shall be of size and layout shown on the Drawings and shall be similar to Model PHP75 as manufactured by the Supersine Company, Tactile Signage, Inc., or an approved equal.

2.02 TACTILE SIGNAGE

A. Tactile signage stating "EXIT" and complying with ICC/ANSI A117.1, shall be installed adjacent to the latch side of the door, 48" minimum/60" maximum above the finished floor to center of sign.

Sign shall be 4"x4" unless space is restricted, then 2"x8" sign shall be used.

Locate at doors #51, 53, 54, 56, 61, 66, 67, 68 and 2 existing side doors un-numbered.



2.03 INTERIOR ROOM SIGNAGE

- A. <u>Style</u>: Signs shall be single-faced, Lettering Specialists, Inc. Tactile Signage, Inc., or an approved equal, radiused corners, beveled edge with decorative reveal around the perimeter; Optima semi-bold style, color as selected by Architect. Schedule shall be as furnished by the Architect/Owner. Composition shall be a design similar to manufacturers standards and meeting all requirements of Americans with Disabilities Act (ADA). Signs shall be mounted with double-faced tape as furnished by the manufacturer.
- B. <u>Pictograms</u>: Pictograms (where required) shall be accompanied by the equivalent verbal description placed directly below the pictogram. The border dimensions of the pictogram shall be 6 inches minimum in height. Pictograms, like non-permanent text, may be recessed.
- A. <u>Mounting Location and Height</u>: Signs shall be installed on the wall adjacent to the latch side of the door. Where there is no wall space to the latch side of the door, including at double leaf doors, signs shall be placed on the nearest adjacent wall. Mounting height

shall be 60 inches above the finished floor to the centerline of the sign.

C. SCHEDULE:

Types:

Room No.	Description	Qty.	Sign Type
144	Men (w/ ADA Symbol)	1	В
145	Women (w/ ADA Symbol)	1	А



PART 3 - EXECUTION

3.01 EXAMINATION

- A. Before installing signs, verify that mounting surfaces are completely finished and ready for installation. Inspect surface to be sure it is clean and free from contaminants that may adversely affect mounting system adhesion.
- B. Do not install signs until surfaces are acceptable. Notify Architect if there are any questions as to suitability of installation surfaces or installation locations.

3.02 INSTALLATION

- A. Install signs in accordance with manufacturer's instructions and in accordance with ADA guidelines for location and as indicated in schedules.
- B. Install after doors are installed and after doors and walls are finished.
- C. Assure signs are installed level.
- D. Mounting Location and Height: Signs shall be installed on the wall adjacent to the latch side of the door. Where there is no wall space to the latch side of the door, including at double leaf doors, signs shall be placed on the nearest adjacent wall. Mounting height shall be 60 inches above the finished floor to the centerline of the sign.

3.03 CLEANING AND PROTECTION

A. At completion of the installation, clean soiled sign surfaces in accordance with the manufacturer's instructions. Protect units from damage until acceptance by the Owner.

END OF SECTION

SECTION 10522 - FIRE EXTINGUISHERS AND ACCESSORIES

PART 1 - GENERAL

- 1.01 Work Included
 - A. Fire extinguishers
 - B. Cabinets and wall mounting brackets

1.02 References

- A. NFPA 10 Portable Fire Extinguishers.
- 1.03 Quality Assurance
 - A. Conform to NFPA 10 requirements for extinguishers.

1.04 Submittals

- A. Submit product data.
- B. Submit manufacturer's installation instruction.
- 1.05 Operation and Maintenance Data
 - A. Submit manufacturer's operation and maintenance data.
 - B. Include test, refill or recharge schedules, procedures, and re-certification requirements.

1.06 Environmental Requirements

A. Do not install extinguishers when ambient temperatures may cause freezing.

PART 2 - PRODUCTS

- 2.01 Acceptable Manufacturers
 - A. Larsen
 - B. J.L. Industries
 - C. Modern Metal Products.
 - D. Substitutions: Reviewed equal.
- 2.02 Extinguishers

- A. Fire Extinguishers #1 #9, shall be Larsen Model MP10, 10 lbs., U.L. Rating 4A-60B:C.
- B. For location of extinguishers, see Floor Plan.
- 2.03 Cabinets/Accessories
 - A. Fire Extinguishers #1 #3 shall be mounted in a semi-recessed cabinet, Larsen Model 2409-6R, non fire-rated cabinet, clear anodized aluminum with Vertical Duo, partial glass door and 21/2" rolled edge.
 - B. Fire Extinguishers #4 and #5 shall be wall-mounted with manufacturer's standard bracket.

PART 3 - EXECUTION

- 3.01 Installation
 - A. Install fire extinguishers 36" a.f.f. or as required by NFPA 10. Top of cabinet mounted at 60" a.f.f.
 - B. Secure rigidly in place in accordance with manufacturer's instructions.

End of Section

SECTION 10800 - TOILET ROOM ACCESSORIES

PART 1 - GENERAL

- 1.01 Work Included
 - A. Toilet room accessories.

1.02 Related Work

- A. Wall blocking required to secure accessories
- B. Glazing/caulking
- C. Toilet compartments
- D. Gypsum wallboard systems
- E. Plumbing fixtures
- F. Countertops
- 1.03 References (including but not limited to)
 - A. ANSI A117 1986 <u>Specifications for Making Buildings and Facilities Accessible to and</u> <u>Usable by Physically Handicapped People</u>.
 - B. UBC Chapters 5 and 33 Requirements for Handicapped.
 - C. Title 24, California Code of Regulations, Parts 2, 3, and 5.
 - D. ADA, <u>Accessibility Guidelines for Buildings and Facilities</u>, Federal Register Volume 56, Number 144, Rules and Regulations.
 - E. Fair Housing Amendments Act of 1988, <u>Accessibility Guidelines</u>, Federal Register Volume 56, Number 44.
 - F. Southern Building Code.
- 1.04 Quality Assurance
 - A. Manufacturer
 - 1. Model numbers for toilet room accessories manufactured by Bradley Corp. Washroom accessories are listed to establish a standard of quality for design, function, materials, workmanship and appearance. Other manufacturers may be submitted for evaluation by the architect by following the conditions of the substitutions clause. Unless approval is obtained 10 days prior to the bid date, all bids shall be based on the standard of quality. The architect shall be the sole judge as to the acceptability of all products submitted for substitutions.

- 2. Accessories shall be the products of a single manufacturer. Accessories with tumbler locks shall be keyed alike with the exception of coin boxes in vending equipment.
- B. Regulatory requirements
 - 1. Operation of accessories shall comply with guidelines set forth by the American Disabilities Act, Title III. Documentation and samples to be provided to the architect upon request.

1.05 Submittals

- A. Comply with requirements of Section regarding submittals.
- B. Manufacturer's Data
 - 1. Provide required number copies of:
 - a. Product data sheets.
 - b. Installation instructions.
 - c. Service and parts manual.
- C. Samples
 - 1. Upon request, submit one sample of each item specified. If more than one manufacturer is specified, submit one sample of each item for architect's review.
- 1.06 Product Delivery, Storage, and Handling
 - A. Deliver items in manufacturer's original unopened protective packaging.
 - B. Store materials in original protective packaging to prevent physical damage, or wetting.
 - C. Handle so as to prevent damage to accessories.
- 1.07 Warranty
 - A. Furnish one year guarantee against defects in material and workmanship on all accessories. In addition to the above the following shall apply:
 - 1. Welded stainless steel framed mirrors shall have a fifteen year guarantee against silver spoilage.

PART 2 - PRODUCTS

- 2.01 Toilet Room Accessories Schedule:
 - A. Grab Bars of sizes as shown on plans, #812-001, heavy-duty stainless steel with sanitary

safety grip finish, concealed mounting kits to be included.

- B. Mirror 58" x 42", #7802-30 x 42, angle framed mirror, ¹/₄" tempered glass.
- C. Paper Towel Dispenser #2494 Electronic Sensor Roll Towel Dispenser, ABS Plastic, Surface-mounted
- D. Soap Dispenser, Model #6-3300 "Verge-Metro Series", brushed stainless steel finish, counter-mounted, top-fill tank 70.5 oz., coordinates with sink faucet.
- E. Toilet Tissue Dispenser with shelf, Model #5263, dual-roll, non-controlled delivery, satin finish stainless steel.
- 2.02 Materials (if applicable to items in contract)
 - A. All cabinets shall be constructed of 18-8, type 304 stainless steel.
 - B. All waste receptacle shall be constructed of 18-8, type 304 stainless steel or rigid molded leak-proof plastic.
 - C. Waste receptacles or cabinets manufactured of type 400 stainless steel are not acceptable.
 - D. All tumbler locks to be fastened to accessories with lock nuts. Fastening locks to units with spring clip is not acceptable.

PART 3 - EXECUTION

3.01 Inspection

- A. Check wall opening for dimensions, plumbness of blocking or frames that would affect installation of recessed accessories. For surface mounted accessories check condition of wall and confirm installation of backing within wall.
- B. Verify spacing of plumbing fixtures and toilet compartments that affect installation of toilet room accessories.

End of Section
Air Powered Dock Leveler

AIR POWERED DOCK LEVELERS 11160

PART 1 - GENERAL

- 1.1 CONDITIONS SPECIFIED ELSEWHERE: Section 010000 General Requirements.
- 1.2 SUBMIT SHOP DRAWINGS showing pit dimension (length, width and depth), and anchorage of curb angle and embedded plates.
- 1.3 SUBMIT 3 copies of manufacturer's Owner's Manual, Maintenance Manual and Master Service Manual to the A/E. Also, provide manufacturer's maintenance video tape at same time.
- 1.4 WARRANTY: Proposals submitted without the following written warranties will be considered non-responsive. Standard warranty shall be 5 years parts and 1 year labor with an extended warranty as listed below.
- 1.4.1 This warranty is based on a standard fork lift truck operating procedure. A standard procedure is; no load shall exceed the rated lift capacity of the truck, and no load shall be pre-staged or stacked and pushed or pulled over the dock leveler into or out of the truck.
- 1.4.2 Dock leveler manufacturer shall provide with his bid a written 10-year money back warranty on dock levelers. Warranty shall be based on the following criteria:

Gross weight of fork lift and load shall not exceed <u>8,500</u> lbs.

User's operation shall not exceed 3_full truckloads per 24-hour period over any one dock position.

Lift truck speed shall be no more than 5 mph. Leveler grade shall be no more than the recommended grade as determined by the material handling equipment manufacturer and never more than 7.17%.

1.4.3 Dock leveler parts covered under the warranty shall include:

Lip Assembly Rear Hinges and Hinge Pins Front Hinge and Hinge Pins Front Hinge Assembly Platform Assembly

1.4.4 Air Tower covered under 5 year warranty.

AIR POWERED DOCK LEVELERS 11160

PART 2 - PRODUCTS

- 2.1 AIR POWERED DOCK LEVELERS RHA-4000 shall be manufactured by Rite-Hite, or an approved substitute. Dock levelers shall be sized by the manufacturer to meet the warranty requirements specified herein.
- 2.1.1 Recessed adjustable dock levelers shall be <u>7</u>' wide x <u>6</u>' long, with a minimum <u>18</u>" lip and a <u>10,000</u> lb. capacity rating. Unit to have an operational range of 12" above and below dock level. Equip each unit with two (2), 12" high x 4" deep molded dock bumpers
- 2.1.2 Dock leveler shall meet ANSI MH30.1-2000 test load specifications with proper documentation from a 3rd party.
- 2.1.3 Platform shall have a minimum of (8) interior deck beams plus external working range toeguards.
- 2.1.4 When leveler is in stored position, the leveler lip will provide an integral and automatically- positioned, impact-rated, solid barrier 5" above building floor to help prevent accidental falls from vacant dock positions. Unobstructed end loading shall be possible from below dock level. Overlapping platform barriers or pinch points are not acceptable.
- 2.1.5 Levelers shall utilize cylindrical polyurethane fabric air tower to raise the platform deck. Air tower fabric shall not come in contact with the floor of the leveler pit during operation or at rest.
- 2.1.6. Automatic night locks to be integral part of manufacturer's standard dock levelers.
- 2.1.7 Full operating range telescoping toe guards to close off sides when leveler is in the highest upward position. Working range of 12".
- 2.1.8 Positive acting Safe-T-Strut[™] maintenance support system will support lip and deck. This system must withstand a 10,000 lb. moving load and provide OSHA approved lockout/tag-out capabilities.
- 2.1.9 Levelers shall have ramp flex of 4" to compensate for unlevel trailer beds. Rearhinges shall be fixed and shall not rise above floor level.

AIR POWERED DOCK LEVELERS 11160

PART 2 - PRODUCTS (continued)

- 2.1.10 Dock leveler control box: All individual components, as well as the complete box unit, shall be UL-approved.
- 2.1.11 Air tower shall be free floating from bottom of deck to allow easy cleaning of pit without manufacturer-supplied tools.

PART 3 - EXECUTION

- 3.1 INSTALLER shall examine the substrate and conditions under which dock levelers and truck restraints are to be installed and notify the A/E and Contractor in writing 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 in a manner acceptable to the installer.
- 3.2 DOCK LEVELER MANUFACTURER'S REPRESENTATIVE shall install dock levelers in accordance with approved shop drawings and manufacturer's recommendations. Location of dock levelers shall be indicated on drawings.
- 3.3 SHIM DOCK LEVELERS as necessary, weld into pit.
- 3.4 ADJUST UNITS to operate smoothly.
- 3.5 AFTER INSTALLATION is completed, a representative of the manufacturer shall examine the installation and require that all connections and adjustments necessary to assure proper operation of dock levelers be made. Before acceptance, a demonstration shall be conducted in the presence of the owner's representative to guarantee that all levelers operate properly in every respect. In addition, a detailed user/operator training session shall be conducted at time and place agreed upon by owner's representative and manufacturer's representative.

SECTION 210000 - FIRE PROTECTION SYSTEMS

PART 1 - GENERAL

1.1 DESCRIPTION OF WORK:

- A. Extent of fire protection systems work is as indicated on the Drawings to provide a fire suppression system to suppress the fit-out building area 100% as indicated on Drawings. Work to suppress these areas shall be performed in accordance with NFPA-13 as a wet-pipe system. System is to be a wet pipe system as indicated on the Drawings. General classification for areas suppressed is <u>Ordinary Hazard Group II</u>, and a warehouse suppression system with densities indicated on the drawings. Warehouse area to suppress a <u>Class III storage commodity</u>. Office are to be a Light hazard.
- B. Before submitting bid, examine all Mechanical, Architectural, and Structural Drawings, visit the site and become acquainted with all conditions that may, in any way whatsoever, affect the execution of this work.
- C. Furnish all material, labor, tools, equipment and supervision required for installation of a complete fire protection stand pipe system and limited area fire protection system as indicated on the project drawings. Include all necessary piping, sprinkler heads, test connections, valves, drains, fire department connections, etc.
- D. The Contractor shall provide flushing and sterilization of all water lines in accordance with current Kentucky Plumbing Codes, Rules and Regulations and shall make connection to domestic water mains in accord with current rules and regulations of the State Department of Sanitary Engineering and Division of Water Quality.
- A. Piping systems shall be hydraulically sized based fire flow data indicated on the Drawings. All hydraulic calculations shall include at least a <u>5% safety factor</u> on pressure.

1.2 QUALITY ASSURANCE:

- A. Manufacturers: Firms regularly engaged in manufacturer of fire protection piping systems products, of types, materials, and sizes required, whose products have been in satisfactory use in similar service for not less than 5 years.
- B. Installer: A firm with at least 5 years of successful installation experience on projects with fire protection piping systems work similar to that required for project.
- C. Local Fire Department/Marshall Regulations: Comply with governing regulations pertaining to fire sprinkler piping.

1.3 SUBMITTALS:

- A. Shop Drawings: Submit scaled layout drawings for fire protection pipe and fittings including, but not necessarily limited to, pipe and tube sizes, locations, elevations and slopes of horizontal runs, wall and floor penetrations, and connections. Show interface and spatial relationship between piping and proximate equipment. Prepare detailed design of system in accordance with all local and national codes and the following guidelines.
- B. Complete shop drawings shall be submitted to the State Fire Marshall office for approval. No work shall proceed until shop drawings are approved. Indicate all information required for review by NFPA-13.
- C. The Contractor shall submit these drawings to the Engineer through the General Contractor and Architect. The Engineer will review these drawings and will return these back to the Contractor. It is the Contractor's responsibility to correct any comments and to submit the reviewed drawings to the fire marshal's office for their review and approval. No work shall be done until drawings are approved by the authority having jurisdiction.
- D. All equipment, devices and materials included in the installation shall be approved or listed by Underwriters' Laboratories or other nationally recognized testing laboratories.

PART 2 - PRODUCTS

2.1 FIRE PROTECTION PIPING MATERIALS AND PRODUCTS:

- A. Pipe & Fittings
 - 1. Interior Piping:
 - a. Up to 2" (Interior) Schedule 40 ASTM A-53 black steel; 175# cast iron screwed fittings or Schedule 10, ASTM A-135 black steel with victaulic or similar type approved fittings.
 - b. 2¹/₂" and larger (Interior) Schedule 40 black steel with flanged, welded or victaulic (or similar) type approved fittings or Schedule 10, ASTM A-135 black steel with victaulic or similar type approved fittings.
 - 2. Exterior Piping:

- a. Piping for the Fire Department Line and Fire Suppression lead in to be ductile iron. SDR-18 "Blue Brute" C900 piping is also acceptable, if acceptable to the local water utility.
- B. Sprinkler Head Cabinet:
 - 1. Furnish and install a cabinet, clearly labeled, with five (5) sprinklers of each type complete with required wrenches. Locate as directed by Engineer. Label "Sprinkler Heads".
- C. <u>Fire Department Connection</u>:
 - 1. If not provided by the Water Utility, furnish and install a fire department connections with threads as approved by the local fire department; cast brass polished and chromium plated; with connection sizes and lettering as directed by the local authority having jurisdiction; Viking, Automatic Sprinkler Corporation, Potter-Roemer or approved equivalent. Ensure size and type of threads matches that of the serving fire department.
- D. <u>Flow Indicator Switches</u>:
 - 1. Furnish and install flow indicator switches as required by NFPA 13. All flow indicator switches shall be UL approved. Coordinate with Fire Alarm System supplier/installer.
- E. <u>Tamper Switches for Water Shut-Off Valves</u>
 - Furnish and install tamper switches where required by NFPA 13. All tamper switches shall be UL approved. Coordinate with fire alarm system supplier/installer. All tamper switches located in fire protection pits shall be waterproof, capable of operating beneath water and be NFPA approved.
- F. Signs:
 - 1. Appropriate code approved and required signs shall be installed on all control valves, drains, inspector's test, etc., indicating the function, installation, etc. Signs shall be neatly affixed with rust inhibitive screws, rivets or where hung from piping; with stainless steel No. 14 AWG wire. Refer also to Section regarding Mechanical Identification.
 - 2. Provide building identification for the fire department connection to this building. Exterior fire department connection shall be stamped and painted metal; lamacoid plates for the fire department connections is not acceptable.
- G. Check Valves:
 - 1. 2¹/₂" and over; listed and approved by UL and FM; marked SV-FM; 175# working pressure; 1 BBM; flanged; equivalent to Mueller, Scott or Lunkenheimer.

- 2. 2" and under; 150# working pressure; bronze; screwed; equivalent to Jenkins, Scott or Lunkenheimer.
- H. Gate Valves:
 - 1. 2¹/₂" and over; listed and approved by UL and FM; marked SV-FM; 175# working pressure; 1 BBM; OS&Y; flanged; cast iron discs; bronze seat rings; four point wedging mechanism; equivalent to Mueller, Scott or Lunkenheimer.
 - 2. 2" and under; 150# working pressure; bronze; rising stem; screwed; bronze discs; bronze seat rings; two point wedging mechanism; equivalent to Jenkins, Scott or Lunkenheimer.

I. Inspection Test Connections & Pressure Gauges:

- 1. A 1" inspection test connection as required by the Kentucky Building Code. Discharge shall run to open air.
- 2. Control valve for test connection shall be installed not over 7' above the floor.
- 3. A pressure gauge at the inspection. Test connection at each location indicated on the Plans. Pressure gauges shall be $2\frac{1}{2}$ " diameter and readable from the floor.
- J. Sleeves and Escutcheon Plates:
 - 1. Provide cast brass chrome plated split ring type escutcheons where piping penetrates walls, ceilings and floors, whether in finished areas or not.
- K. Sprinkler Heads:
 - 1. Grinnell, Star, Reliable, Viking, Central Sprinkler Corporation, or approved equivalent as follows:
 - 2. Where piping is exposed: "Standard up right".
 - 3. Where piping is concealed above finished ceilings, provide two piece, semirecessed, Pendant sprinkler heads with removable escutcheon plates. All piping shall be concealed throughout.
 - 4. Install sprinkler head guards where heads are subject to physical abuse. Heads located below seven (7) feet above floor, etc..
 - 5. Sprinkler head degree ratings shall be determined by the area serviced in accord with current Codes and Standard Practices. Indicate degree ratings on submitted Shop Drawings.

- 6. NOTE: "Omega" brand & Central Sprinkler Corporation sprinkler heads shall be prohibited.
- L. Hangers:
 - 1. All piping shall be adequately and permanently supported in an approved manner on approved hangers (Submit with drawings).

PART 3 - EXECUTION

- 3.1 PIPING INSTALLATION;
 - A. All piping, valving, devices, heads, etc. shall be installed in accordance with NFPA 13.
 - B. Pipe shall be accurately cut from job measurements and shall be neatly aligned, securely connected, and properly supported. Provide pipe sleeves where piping passes through structure. Threaded, welded, and mechanical joints shall be made in a workmanlike manner according to good pipe fitting practices. Welding shall be performed by a certified welder.
 - C. Locate piping runs vertically and horizontally (pitched to drain) and avoid diagonal runs wherever possible.
 - D. Electrical Equipment Spaces: Do not run piping through transformer vaults, over panels and other electrical or electronic equipment spaces and enclosures.
 - E. Thread pipe in accordance with ANSI B2.1; cut threads full and clean using sharp dies. Ream threaded ends to remove burrs and restore full inside diameter. Apply pipe joint compound, or pipe joint tape (Teflon) where recommended by pipe/fitting manufacturer, on male threads at each joint and tighten joint to leave not more than three threads exposed.
 - F. Ferrous pipe hangers shall comply with standards of NFPA 13.

3.2 SYSTEM DRAINAGE

- A. The entire Sprinkler System (except that part which is below grade and will not freeze) shall be installed so as to allow 100% drainage.
- B. All sprinkler branch piping shall be installed so as to drain back to the main riser. No piping shall be installed which will pool greater than 4 gallons of water without drainage capability.
- C. Approved 2" drain piping shall be provided on sprinkler risers with discharge piping running to nearest open air location on the exterior of the building. Where sprinkler piping is trapped, an approved auxiliary draw-off shall be provided and neatly installed.
- D. All drain valves shall have a metal tag labeled "Sprinkler Drain".

3.3 ADJUST AND CLEAN:

A. Sprinkler Piping Flushing: Prior to connecting sprinkler risers for flushing, flush water feed mains, lead-in connections and control portions of sprinkler piping. After fire sprinkler piping installation has been completed and before piping is placed in service, flush entire sprinkler system, as required to remove foreign substances, under pressure as specified in ANSI/NFPA 13. Continue flushing until water is clear, and check to ensure that debris has not clogged sprinklers.

3.4 FIELD QUALITY CONTROL:

A. Hydrostatic Testing: After flushing system, test fire sprinkler piping with compressed air for a period of 2 hours, at not less Than 125 PSI. Repair or replace piping system as required to eliminate leakage in accordance with ANSI/NFPA standards for "little or no leakage", and retest as specified to demonstrate compliance.

END OF SECTION

220500 - COMMON WORK RESULTS FOR PLUMBING

PART 1 - GENERAL

1.1 GENERAL REQUIREMENTS:

A. All requirements under Division One and the General and Supplementary Conditions of these specifications shall be a part of this section. Each contractor shall be responsible to thoroughly familiarize himself with all its contents as to requirements which affect this division or section. The work required under this section includes all material, equipment, appliances, transportation, services, and labor required to complete the entire system as required by the drawings and specifications.

1.2 SCOPE

- A. The work included in this division consists of the furnishing of all labor, equipment, transportation, supplies, material, appurtenances and services necessary for the satisfactory installation of the complete and operating Plumbing System(s)/Equipment indicated or specified in the Contract Documents.
- B. Any materials, labor, equipment or services not mentioned specifically herein which may be necessary to complete or perfect any part of the Plumbing Systems in a substantial manner, in compliance with the requirements stated, implied or intended in the drawings and, or specifications, shall be included as part of this Contract.
- C. 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 the responsibility of the Contractors involved to coordinate all new systems with items of construction provided by others, and to relocate items which interfere with new equipment or materials required for the complete installation without additional cost to the Owner.

1.3 DEFINITIONS AND ABBREVIATIONS

- A. Contractor Any Contractor whether proposing or working independently or under the supervision of a General Contractor and, or Construction Manager and who installs any type of mechanical work or, the General Contractor.
- B. Engineer The Consulting Mechanical-Electrical Engineers either consulting to the Owners, Architect, other Engineers, etc.
- C. Architect The Architect of Record for the project.

- D. Furnish Deliver to the site in good condition and turn over to the Contractor who is to install.
- E. Provide Furnish and install complete, tested and ready for operation.
- F. Indicated Shown on the Drawings or Addenda thereto.
- G. Typical Where indicated repeat this work, method or means each time the same or similar condition occurs whether indicated or not.
- H. OSHA Office of Safety and Health Administration.
- I. NEC National Electrical Code.
- J. NFPA National Fire Protection Association.
- K. AGA American Gas Association
- L. ASME American Society of Mechanical Engineers.
- M. ANSI American National Standards Institute.
- N. ASHRAE American Society of Heating, Refrigeration and Air Conditioning Engineers.
- O. NEMA National Electrical Manufacturers Association.
- P. UL Underwriters Laboratories.
- 1.4 INSPECTION OF THE SITE:
 - A. The contractor shall personally inspect the site of the proposed work and inform himself fully as to the conditions under which the work is to be done. Failure to do so will not be considered sufficient justification to request or obtain extra compensation over and above the contract price.

1.5 MATERIAL AND WORKMANSHIP:

A. All material and apparatus shall be new and in first class condition. All workmanship shall be of the finest possible by experienced mechanics. All installations shall be made in a manner that will comply with applicable Codes and laws. In general, all materials and equipment shall be of commercial specification grade in quality.

1.6 DRAWINGS AND SPECIFICATIONS

- A. The drawings are diagrammatic only and indicate the general arrangement of the systems and are to be followed. If deviations from the layouts are necessitated by field conditions, detailed layouts of the proposed departures shall be submitted to the Engineer for approval before proceeding with the work. The drawings are not intended to show every item that may be necessary to complete the systems. All proposers shall anticipate that additional items may be required and submit their bid accordingly.
- B. Each 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.
- C. The Engineer shall reserve the right to make adjustments in location of piping, ductwork, equipment, etc. where such adjustments are in the interest of improving the project.
- D. Unless dimensioned, the mechanical drawings only indicate approximate locations of equipment, piping, 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 to insure no conflict with other work.

1.7 COORDINATION:

- A. Coordinate all work with that of other trades so that the various components of the systems will be installed at the proper time, will fit the available space, and will allow proper service access to those items requiring maintenance. Any components which are installed without regard to the above shall be relocated at no additional cost to the owner.
- B. It is the Contractor's responsibility to provide materials with trim which will fit properly the types of ceiling, wall, or floor finishes actually installed. Model numbers in specifications or shown on drawings are not intended to designate the required trim.

1.8 ORDINANCES AND CODES:

- A. Comply with National Fire Protection Association codes, Kentucky Building Code, Kentucky Plumbing Code, and/or all other applicable codes and ordinances. Obtain and pay for all permits. Contractor shall be held responsible for any violation of the law.
- B. The Contractor shall give all necessary notices, obtain and pay for all permits, government sales taxes, fees, inspections and other costs, in connection with his work. He shall also file all necessary plans, prepare all documents and obtain all necessary approvals of all governmental departments having any jurisdiction, whether indicated or

specified or not.

C. The contractor shall also obtain all required certificates of inspection for his work and deliver same to the Engineers before request for acceptance and final payment for the work.

1.9 **PROTECTION OF EQUIPMENT:**

- A. Adequately protect equipment from damage after delivery to job. Cover with heavy polyethylene plastic as required to protect from plaster, dirt, paint, water, or physical damage. Equipment which has been damaged by construction activities will be rejected, and contractor is obligated to furnish new equipment of a like kind.
- B. Keep premises broom clean at all times from foreign material created under this contract. All piping, equipment, etc. shall have a neat and clean appearance at the termination of the work.

1.10 EQUIPMENT AND MATERIALS SUBSTITUTIONS OR DEVIATIONS

- A. When any Contractor requests approval of materials and/or equipment of different physical size, capacity, function, color, access, it shall be understood that such substitution, if approved, will be made without additional cost to anyone other than the Contractor requesting the change regardless of changes in connections, space requirements, electrical characteristics, etc. from that indicated, electrical service, etc.. In all cases where substitutions affect other trades, the Contractor requesting such substitutions shall advise all such Contractors of the change and shall renumerate them for all necessary changes in their work.
- B. <u>NOTE:</u> Any drawings, Specifications, Diagrams, etc., required to describe and coordinate such substitutions or deviations shall be professionally prepared at the responsible Contractor's expense. Review of Shop Drawings by the Engineers does not in any way absolve the Contractor of this responsibility.
- C. Notwithstanding any reference in the specifications to any article, device, product, material, fixture, form, or type of construction by name, make or catalog number, such reference shall be interpreted as establishing a standard of quality and shall not be construed as limiting competition; any devices, products, materials, fixtures, forms, or types of construction which, in the judgment of the Engineer, are equivalent to those specified are acceptable, provided the provisions of the paragraph immediately preceding are met. Requested substitutions shall be submitted to the Engineer a minimum of five days prior to bids.

1.11 SUPERVISION OF WORK

A. Each Contractor shall personally supervise the work for which he is responsible or have a competent superintendent, approved by the Engineers, on the work at all times during progress with full authority to act for him.

1.12 SHOP DRAWINGS:

- A. Submit for approval eight sets of manufacturers shop drawings of all major items of equipment and all items requiring coordination between contractors. Before submitting shop drawings and material lists, the contractor shall verify that all equipment submitted is mutually compatible and suitable for the intended use, and shall fit the available space and allow ample room for maintenance. The Engineer's checking and subsequent approval of such shop drawings shall not relieve the contractor from responsibility for errors in dimensions, details, size of members, or quantities; or omissions of components or fittings; or for coordinating items with actual building conditions. Provide any needed wiring diagrams.
- B. Catalog data must have the item or model number clearly marked and all accessories indicated. Mark out all inapplicable items.
- C. NOTE: Any shop drawings received without being reviewed and stamped by the Contractor shall be returned Rejected without review.

1.13 OPERATION AND MAINTENANCE INSTRUCTIONS:

- A. Submit to the architect four (4) copies each of material for maintenance and operation instruction manuals, appropriately bound into manual form including approved copies of the following, revised if necessary to show system and equipment as actually installed:
 - 1. Manufacturers Catalog Sheets
 - 2. Wiring Diagrams
 - 3. Maintenance Instructions
 - 4. Recommended Maintenance Schedules and Timelines
 - 5. Operating Instructions
 - 6. Parts Lists
 - 7. Preventative Maintenance Recommendations
- B. All binders shall be as per the applicable Division I General Specifications.

1.14 GUARANTEE:

A. Each Contractor shall guarantee all equipment, apparatus, materials, and workmanship entering into this Contract to the best of its respective kind and shall replace all parts at

his own expense, which are proven defective for a duration as indicated in the Division I General Conditions and Specifications.

B. Where such duration is not identified, then guarantee shall be for one year from final acceptance of the work by the Engineer/Architect. The effective date of completion of the work shall be the date of the Engineer's (Architect's) <u>Statement of Substantial</u> <u>Completion</u>. Items of equipment which have longer guarantees, as called for in these specifications, 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 Engineer shall then submit these warranties, etc. to the Owner. Refer to other sections for any special or extra warranty requirements.

1.15 CONDUCT OF WORKMEN

- A. Each Contractor shall be responsible for the conduct of all workmen under his supervision. Misconduct on the part of any workman 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 of alcoholic beverages or other intoxicants, narcotics, barbiturates, hallucinogens or debilitating drugs on the job site is strictly forbidden.
- 1.16 ROUGH-IN:
 - A. Coordinate without delay all roughing-in with general construction. All piping, conduit, rough-in shall be concealed except in unfinished areas and where otherwise shown.
- 1.17 CUTTING AND PATCHING:
 - A. Each Mechanical Contractor shall be responsible for all openings that he may require in floors, roofs, ceilings, walls, etc., and shall coordinate all such work prior to execution. Improperly located openings shall be reworked at the expense of the responsible Contractor.
 - B. Each Mechanical 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 structure, 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 and Engineer.
 - C. 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, of like type to match adjacent surfaces and in a manner

acceptable to the Architect & Engineer.

- D. Where the installation of conduit, ducts, piping, etc. requires the penetration of fire or smoke rated walls, ceilings or floors, the penetrations MUST be made using a U.L. listed through penetration assembly. These materials must be U.L. listed as a recorded assembly and shall be submitted for approval prior to use.
- E. Piping 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 pipe around which it is installed.

1.18 <u>LINTELS</u>

A. The Mechanical Contractor shall provide lintels for all masonry bearing openings required for the mechanical work (Louvers, wall boxes, duct penetrations, etc.). Lintels shall be sized as indicated by the structural drawings and specifications. Coordinate requirements with the general contractor and the Structural Engineer. Contact Engineer for additional direction if necessary. Plan all lintel depths to ensure maintenance of all Architectural ceiling levels. Also, plan all required angles for fire damper and UL listed sleeves for a total depth for coordination with ceiling heights. 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 Structural Engineer. Provide lintels where ever bearing walls are penetrated. Plan the location of all lintels prior to any penetrations being performed.

1.19 ACCESSIBILITY

A. The Contractor shall locate and install all equipment so that it may be serviced, and maintained as recommended by the manufacturer. Allow ready access and removal of the entire unit and, or parts such as valves, filters, fan belts, motors, prime shafts, etc.

1.20 REQUIRED CERTIFICATIONS

- A. Upon completion of the project, the Contractor shall deliver all inspection certificates acquired during the course of the project to the Owner for their records, inclusive of the boiler certificate (if applicable).
- B. The Contractor shall upon completion of the Final Punch list, deliver to Architect and Engineer a written certification that all systems and work has been completed in compliance with the plans and specifications. The Contractor also shall deliver over to the Owner all required maintenance manuals and phone numbers of the equipment suppliers. The delivery of these documents and certifications will be required prior to final payment and release of retainage.

1.21 INDEMNIFICATION

A. The Contractor(s) shall hold harmless and indemnify the Engineer, employees, officers, agents 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.

PART 2 - PRODUCTS

2.1 NONE

PART 3 - EXECUTION

3.1 NONE

END OF 220500

220519: METERS AND GAGES

PART 1 - GENERAL

1.1 DESCRIPTION OF WORK:

- A. Extent of gauges and thermometers required by this section is indicated on drawings and/or specified in other Division 22 sections.
- 1.2 QUALITY ASSURANCE:
 - A. Manufacturers: Firms regularly engaged in manufacturer of pressure gauges and thermometers, of types and sizes required, whose products have been in satisfactory use in similar service for not less than 5 years.
- 1.3 SUBMITTALS:
 - A. Product Data: Submit catalog cuts, specifications, and installation instructions, for each type of measuring device required. Submit showing Manufacturer's figure number, size, and features for each required device.

PART 2 - PRODUCTS

- 2.1 TEMPERATURE GAGES:
 - A. Direct Mount Dial Thermometers:
 - 1. General: Provide direct mount dial thermometers of materials, capacities, and ranges indicated, designed and constructed for use in service indicated.
 - 2. Type: Vapor tension, universal angle.
 - 3. Case: Drawn steel or brass, clear acrylic plastic lens, 4¹/₂" diameter.
 - 4. Adjustable Joint: Die cast aluminum, 180° adjustment in vertical plane, 360° adjustment in horizontal plane, with locking device.
 - 5. Thermal Bulb: Copper with phosper bronze bourbon pressure tube, on scale division accuracy.
 - 6. Movement: Brass precision geared.
 - 7. Scale: Progressive, satin faced, non-reflective aluminum, permanently etched markings.
 - 8. Stem: Copper plated steel, or brass, for separable socket, length to suit

installation.

- 9. Range: Conform to the following:
 - a. Hot & Cold Water: $40^{\circ} 240^{\circ}F(10^{\circ} 115^{\circ}C)$.
- 10. Available Manufacturers: Subject to compliance with requirements, manufacturers offering direct mount dial thermometers which may be incorporated in the work include, but are not limited to the following:
 - a. Marsh Instrument Co., Unit of General Signal.
 - b. Trerice (H.O.) Co.
 - c. Weiss (Albert A. & Son, Inc.
- B. Dial Type Insertion Thermometers:
 - 1. General: Provide dial type insertion thermometers of materials, capacities, and ranges indicated, designed and constructed for use in service indicated.
 - 2. Type: Bi-metal, stainless steel case and stem, 1" diameter dial, dust and leak proof, 1/8" diameter stem with nominal length of 5".
 - 3. Accuracy: 0.5% of dial range.
 - 4. Range: Conform to the following:
 - a. Hot & Cold Water: 0° 220°F (-10°-110°C).
 - 5. Available Manufacturers: Subject to compliance with requirements, manufacturers offering direct mount dial type insertion thermometers which may be incorporated in the work include, but are not limited to the following:
 - a. Marsh Instrument Co., Unit of General Signal.
 - b. Taylor Instrument Process Control Div., Sybron Corp.
 - c. Trerice (H.O.) Co.
 - d. Weiss (Albert A.) & Son, Inc.

C. THERMOMETER WELLS:

- 1. General: Provide thermometer wells constructed of brass or stainless steel, pressure rated to match piping system design pressure. Provide 2" extension for insulated piping.
- 2.2 PRESSURE GAGES AND FITTINGS:
 - A. General: Provide pressure gages of materials, capacities and ranges indicated, designed

and constructed for use in service indicated.

- B. Type: General use, 1% accuracy, ANSI B 40.1 grade A, phosphor bronze bourdon type, bottom connection.
- C. Case: Drawn steel or brass, clear acrylic plastic lens, 4¹/₂" diameter.
- D. Connector: Brass with ¹/₄" male NPT.
- E. Scale: White coated aluminum, with permanently etched markings.
- F. Range: Conform to the following:
 - 1. HVAC Water and steam: 0 100 PSI.
- G. Available Manufacturers: Subject to compliance with requirements, manufacturers offering pressure gages which may be incorporated in the work include, but are not limited to the following:
 - 1. Ametek, U.S. Gauge Div.
 - 2. Marsh Instrument Co., Unit of General Signal.
 - 3. Marshalltown, An Eltra Company
 - 4. Trerice (H.O.) Co.
 - 5. Weiss (Albert A.) & Son, Inc.
- H. Pressure Gage Cocks:
 - 1. General: Provide pressure gage cocks between pressure gages and gage tees on piping systems. Construct gage cock of brass with ¹/₄" female NPT on each end, and "T" handle brass plug.
- I. Snubber: ¹/₄" brass bushing with corrosion resistant porous metal disc, through which pressure fluid is filtered. Select disc material for fluid served and pressure rating.
- J. Pressure Gage Connector Plugs:
 - General: Provide pressure gage connector plugs pressure rated for 150 PSI and 200°F. Construct of brass and finish in nickel-plate, equip with ½" NPT fitting, with self-sealing valve core type neoprene gasketed orifice suitable for inserting 1/8" O.D. probe assembly from dial type insertion pressure gage. Equip orifice with gasketed screw cap and chain. Provide extension, length equal to insulation thickness, for insulated piping.

PART 3 - EXECUTION

3.1 INSTALLATION OF TEMPERATURE GAGES:

- A. General: Install temperature gages in vertical upright position, and tilted so as to be easily read by observer standing on floor.
- B. Locations: Install at the following locations, and elsewhere as indicated:
 - 1. At the supply line from the domestic water heaters
- C. Thermometer Wells: Install in piping tee where indicated, in vertical upright position. Fill well with oil or graphite, secure cap.
- 3.2 INSTALLATION OF PRESSURE GAGES:
 - A. General: Install pressure gages in piping tee with pressure gage cock, located on pipe at most readable position.
 - B. Locations: Install in the following locations, and elsewhere as indicated:
 - 1. At inlet and discharge of each pump

END OF 220519

220523 - GENERAL DUTY VALVES FOR PLUMBING PIPING

PART 1 - GENERAL

1. DESCRIPTION OF WORK:

- 1.1 Extent of valves required by this section is indicated on drawings and/or specified in other Division 22 sections.
 - A. Types of valves specified in this section include the following:
 - 1. Gate Valves.
 - 2. Globe Valves.
 - 3. Drain Valves.
 - 4. Ball Valves.
 - 5. Swing and Lift Check Valves.

1.2 QUALITY ASSURANCE:

A. Manufacturers: Firms regularly engaged in manufacturer of valves, of types and sizes required, whose products have been in satisfactory use in similar service for not less than 5 years.

1.3 SUBMITTALS:

A. Product Data: Submit catalog cuts, specifications, installation instructions, and dimensioned drawings for each type of valve. Include pressure drop curve or chart for each type and size of valve. Submit valve schedule showing Manufacturer's figure number, size, location, and valve features for each required valve.

PART 2 - PRODUCTS

2.1 VALVES:

- A. General: Provide factory-fabricated valves recommended by manufacturer for use in service indicated. Provide valves of types and pressure ratings indicated; provide proper selection as determined by Installer to comply with installation requirements. Provide sizes as indicated, and connections which properly mate with pipe, tube, and equipment connections. Where more than one type is indicated, selection is Installer's option.
- 2.2 GATE VALVES:
 - A. Packing: Select valves designed for repacking under pressure when fully opened,

equipped with packing suitable for intended service. Select valves designed so back seating protects packing and stem threads from fluid when valve is fully opened, and equipped with gland follower.

- 1. For Low Pressure Domestic Water Service:
 - a. Threaded Ends 2" and Smaller: Class 125, bronze body, union bonnet, rising stem, solid wedge.
 - b. Flanged Ends 2¹/₂" and Larger: Class 125, iron body bronze mounted, bolted bonnet, rising stem, OS&Y, solid wedge.
 - c. Soldered Ends 2" and Smaller: Class 125, bronze body, screwed bonnet, non-rising stem, solid wedge.
- 2. Available Manufacturers: Subject to compliance with requirements, manufacturers offering gate valves which may be incorporated in the work include, but are not limited to the following:
 - a. Crane Co., Valve Div.
 - b. Fairbanks Co.
 - c. Hammond Valve Corp., Div. of Conval Corp.
 - d. Jenkins Bros., A Corp.
 - e. NIBCO, Inc.
 - f. Powell (Wm.) Co.
 - g. Stockham Valves and Fittings, Inc.
 - h. Walworth Co.

2.3 GLOBE VALVES:

- A. Packing: Select valves designed for repacking under pressure when fully opened, equipped with packing suitable for intended service. Select valves designed so back seating protects packing and stem threads from fluid when valve is fully opened, and equipped with gland follower.
- B. Composition Discs: Where required, provide suitable material for intended service. For stem throttling service, fit composition disc valve with throttling nut.
- C. Comply with the following standards:
 - 1. Bronze Valves: MSS SP-80.
- D. For Domestic Water Service:

- 1. Flanged, Threaded or Solder Ends 2¹/₂" and Larger: Class 150, bronze body, union bonnet, plug-type, OS&Y, renewable seat and disc, rated for severe throttling.
- E. Available Manufacturers: Subject to compliance with requirements, manufacturers offering globe valves which may be incorporated in the work include, but are not limited to, the following:
 - 1. Crane Co., Valve Div.
 - 2. Fairbanks Co.
 - 3. Hammond Valve Corp., Div. of Conval Corp.
 - 4. Jenkins Bros., A Corp.
 - 5. NIBCO, Inc.
 - 6. Powell (Wm.) Co.
 - 7. Stockham Valves and Fittings, Inc.
 - 8. Walworth Co.
- 2.4 SWING CHECK VALVES:
 - A. General: Construct pressure containing parts of valves as follows:
 - 1. Bronze Valves, 125 or 150 PSI: ANSI/ASTM B 62.
 - B. Construct valves of pressure castings free of any impregnating materials.
 - C. Construct valves of bronze, regrinding, with seating angle 40° to 45°, unless composition disc is specified.
 - D. Provide stop plug as renewable stop for disc hanger, unless otherwise specified.
 - E. Construct disc and hanger as separate parts, with disc free to rotate.
 - F. Support hanger pins on both ends by removable side plugs.
- 2.5 Available Manufacturers: Subject to compliance with requirements, manufacturers offering swing check valves which may be incorporated in the work include, but are not limited to the following:
 - 1. Crane Co., Valve Div.
 - 2. Fairbanks Co. (The)
 - 3. Hammond Valve Corp., A Condec Co.
 - 4. Jenkins Bros., A Corp.
 - 5. NIBCO, Inc.

- 6. Powell Co. (The Wm.)
- 7. Stockham Valves and Fittings, Inc.
- 8. Walworth Co.

2.6 LIFT CHECK VALVES:

- A. General: Provide lift check valves, 2" and smaller, constructed of bronze or forged steel to suit service. Construct bronze valves with basic rating of 125 or 150 PSI with pressure containing parts of materials having at least physical properties of ANSI/ASTM B 62. Conform to ANSI /FCI 74-1 for design, rating, and testing. Construct pressure castings, free of any impregnating materials.
- B. Horizontal Lift Check Valves: ¹/₄" to 2", straight pattern threaded or soldered ends, pressure rated for 150 PSI, renewable composition disc, screw-over cap, bronze body.
- C. Spring Loaded Horizontal Lift Check Valves: ¹/₄" to 2", straight pattern, threaded or soldered ends, pressure rated for 150 PSI, renewable composition disc, phosphor bronze wire spring, screw over cap, bronze body.
- D. Available Manufacturers: Subject to compliance with requirements, manufacturers offering lift check valves which may be incorporated in the work include, but are not limited to the following:
 - 1. Fairbanks Co. (The).
 - 2. Hammond Valve Corp., A Condec Co.
 - 3. Jenkins Bros., A Corp.
 - 4. Lunkenheimer Co. (The), Div. Conval Corp.
 - 5. Powell Co. (The Wm.).
 - 6. Stockham Valves & Fittings, Inc.
- 2.7 BALL VALVES:
 - A. General: Select with port area equal to or greater than connecting pipe area, include seat ring designed to hold sealing material.
 - B. For Domestic Water Service:
 - 1. Threaded Ends 2" and Smaller: Class 125, bronze 2 piece body, bronze ball, bronze stem.
 - 2. Soldered Ends 2" and Smaller: Class 125, bronze, 2 piece body, bronze ball, bronze stem.

- C. Available Manufacturers: Subject to compliance with requirements, manufacturers offering ball valves which may be incorporated in the work include, but are not limited to the following:
 - 1. Conbraco Industries, Inc.
 - 2. Crane Co., Valve Div.
 - 3. Fairbanks Co.
 - 4. Hammond Valve Corp., Div. of Conval Corp.
 - 5. Jamesbury Corp.
 - 6. NIBCO, Inc.
 - 7. Stockham Valves and Fittings, Inc.
 - 8. Walworth Co.

2.8 DRAIN VALVES:

- A. For Low Pressure Drainage Service:
 - 1. Threaded Ends 2" and Smaller: Class 125, bronze body, screwed bonnet, rising stem, composition disc, 3/4" hose outlet connection.
 - 2. Soldered Ends 2" and Smaller: Class 125, bronze body, screwed bonnet, rising stem, composition disc, 3/4" hose outlet connection.
- B. Available Manufacturers: Subject to compliance with requirements, manufacturers offering drain valves which may be incorporated in the work include, but are not limited to, the following:
 - 1. Crane Co., Valve Div.
 - 2. Fairbanks Co.
 - 3. Hammond Valve Corp., Div. of Conval Corp.
 - 4. Jenkins Bros., A Corp.
 - 5. NIBCO, Inc.
 - 6. Walworth, Co.

2.9 SWING CHECK VALVES:

- A. General: Construct pressure containing parts of valves as follows:
 - 1. Bronze Valves, 125 or 150 PSI: ANSI/ASTM B 62.
 - 2. Metallic Seated Bronze Valves, 200 or 300 PSI: ANSI/ASTM B 61.
 - 3. Iron Body Valves: ANSI/ASTM A 126, Grade B.

- B. Comply with MSS SP-71 for design, workmanship, material and testing.
- C. Construct valves of pressure castings free of any impregnating materials. Construct valves of bronze, regrinding, with seating angle 40° to 45°, unless composition disc is specified.
- D. Provide stop plug as renewable stop for disc hanger, unless otherwise specified.
- E. Construct disc and hanger as separate parts, with disc free to rotate.
- F. Support hanger pins on both ends by removable side plugs.
- G. For Domestic Water Service:
 - 1. Threaded Ends 2" and Smaller: Class 125, bronze body, screwed cap, horizontal swing, bronze disc.
 - 2. Soldered Ends 2" and Smaller: Class 125, bronze body, screwed cap, horizontal swing, bronze disc.
 - 3. Flanged Ends 2¹/₂" and Larger: Class 125, iron body bronze mounted, bolted cap, horizontal swing, cast iron disc.
- H. Available Manufacturers: Subject to compliance with requirements, manufacturers offering swing check valves which may be incorporated in the work include, but are not limited to the following:
 - 1. Crane Co., Valve Div.
 - 2. Fairbanks Co. (The)
 - 3. Hammond Valve Corp., A Condec Co.
 - 4. Jenkins Bros., A Corp.
 - 5. NIBCO, Inc.
 - 6. Powell Co. (The Wm.)
 - 7. Stockham Valves and Fittings, Inc.
 - 8. Walworth Co.

2.10 VALVE FEATURES:

A. General: Provide valves with features indicated and, where not otherwise indicated, provide proper valve features as determined by Installer for installation requirements. Comply with ANSI B31.1

- B. Outside Screw and Yoke: Stem and handwheel designed to rise out of bonnet or yoke as valve is operated from closed to open position.
- C. Inside Screw, Non-Rising Stem: Stem and handwheel designed to rotate without rising when valve is operated from closed to open position.
- D. Threaded: Valve ends complying with ANSI B2.1.
- E. Bonnet: Part of gate or globe valve through which stem passes to valve body, and attached to valve body by screws, bolts, union or welding.
- F. Solid Wedge: One piece tapered disc in gate valve, designed for contact on both sides.
- G. Outside Screw and Yoke: Stem and handwheel designed to rise out of bonnet or yoke as valve is operated from closed to open position.
- H. Inside Screw, Non-Rising Stem: Stem and handwheel designed to rotate without rising when valve is operated from closed to open position.
- I. Valve System: Select and install valves with outside screw and yoke stems, except provide inside screw non-rising stem valves where headroom prevents full opening of OS&Y valves.
- J. Renewable Seats: Select and install valves with renewable seats, except where otherwise indicated.

PART 3 - EXECUTION

- 3.1 INSTALLATION:
 - A. General: Except as otherwise indicated, comply with the following requirements:
 - B. Install valves where required for proper operation of piping and equipment, including valves in branch lines where necessary to isolate sections of piping. Locate valves so as to be accessible and so that separate support can be provided when necessary.
 - C. Install valves with stems pointed up, in vertical position where possible, but in no case with stems pointed downward for horizontal plane unless unavoidable. Install valve drains with hose end adapter for each valve that must be installed with stem below horizontal plane.
 - D. Insulation: Where insulation is indicated, install extended stem valves, arranged in proper manner to receive insulation.

- E. Applications Subject to Shock: Install valves with bodies of metal other than cast iron where thermal or mechanical shock is indicated or can be expected to occur.
- F. Valve System: Select and install valves with outside screw and yoke stems, except provide inside screw non-rising stem valves where headroom prevents full opening of OS&Y valves.
- G. Fluid Control: Where throttling is indicated or recognized as principal reason for valve, install globe valves.
- H. Installation of Check Valves:
 - 1. Swing Check Valves: Install in horizontal position with hinge pin horizontally perpendicular to center line of pipe. Install for proper direction of flow.

END OF 220523

220529 - HANGERS AND SUPPORTS FOR PLUMBING PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 DESCRIPTION OF WORK:

- A. Extent of supports, anchors and seals required by this section is indicated on drawings and/or specified in other Division 22 sections.
- B. Types of supports, anchors, and seals specified in this section include the following:
 - 1. Horizontal-Piping Hangers and Supports.
 - 2. Vertical-Piping Clamps.
 - 3. Hanger-Rod Attachments.
 - 4. Building Attachments.
 - 5. Saddles and Shields.
 - 6. Miscellaneous Materials.
 - 7. Anchors.
- C. Supports, anchors, and seals furnished as part of factory-fabricated equipment, are specified as part of the equipment assembly in other Division 22 sections. Also refer to Drawings for notes regarding the post tension slab system.

1.2 QUALITY ASSURANCE:

- A. Manufacturers: Firms regularly engaged in manufacturer of supports, anchors, and seals, of types and sizes required, whose products have been in satisfactory use in similar service for not less than 5 years.
- B. Select and apply pipe hangers and supports, complying with MSS SP-69. Size hangers and supports to support pipe weight and fluid conveyed.

PART 2 - PRODUCTS

2.1 HORIZONTAL-PIPING HANGERS AND SUPPORTS:

A. General: Except as otherwise indicated, provide factory fabricated horizontal-piping hangers and supports complying with ANSI/MSS SP-58, of one of the following MSS types listed, selected by Installer to suit horizontal-piping systems, in accordance with MSS SP-69 and manufacturer's published product information. Use only one type by one manufacturer for each piping service. Select size of hangers and supports to exactly fit pipe size for bare piping, and to exactly fit around piping insulation with saddle or

shield for insulated piping.

- 1. Adjustable Steel Clevises: MSS Type 1.
- 2. Alloy Steel Pipe Clamps: MSS Type 2.
- 3. Steel Double Bolt Pipe Clamps: MSS Type 3.
- 4. Steel Pipe Clamps: MSS Type 4.
- 5. Pipe Hangers: MSS Type 5.
- 6. Adjustable Swivel Pipe Rings: MSS Type 6.
- 7. Adjustable Steel Band Hangers: MSS Type 7.
- 8. Adjustable Band Hangers: MSS Type 9.
- 9. Extension Split Pipe Clamps: MSS Type 12.
- 10. Single Pipe Rolls: MSS Type 41.
- 11. Pipe Roll Stands: MSS Type 44.
- 12. Adjustable Roller Hangers: MSS Type 43.
- 13. Pipe Rolls and Plates: MSS Type 45.

2.2 VERTICAL-PIPING CLAMPS:

- A. General: Except as otherwise indicated, provide factory fabricated vertical-piping clamps complying with ANSI/MSS SP-58, of one of the following types listed, selected by Installer to suit vertical piping systems, in accordance with MSS SP-69 and manufacturer's published product information. Select size of vertical piping clamps to exactly fit pipe size of bare pipe.
 - 1. Two-Bolt Riser Clamps: MSS Type 8.
 - 2. Four-Bolt Riser Clamps: MSS Type 42.

2.3 HANGER-ROD ATTACHMENTS:

- A. General: Except as otherwise indicated, provide factory fabricated hanger-rod attachments complying with ANSI/MSS SP-58. Select size of hanger-rod attachments to suit hanger rods.
 - 1. Steel Clevises: MSS Type 14.
 - 2. Swivel Turnbuckles: MSS Type 15.
 - 3. Steel Weldless Eye Nuts: MSS Type 17.

2.4 BUILDING ATTACHMENTS:

1. General: Except as otherwise indicated, provide factory fabricated building attachments complying with ANSI/MSS SP-58

2.5 SADDLES AND SHIELDS:

- 1. General: Except as otherwise indicated, provide saddles or shields for piping hangers and supports, factory-fabricated, for all insulated piping. Size saddles and shields for exact fit to mate with pipe insulation.
- B. Protection Saddles: MSS Type 39; fill interior voids with segments of insulation matching adjoining insulation.
- C. Protection Shields: MSS Type 40; of length recommended by manufacturer to prevent crushing of insulation.

2.6 MANUFACTURERS OF HANGERS AND SUPPORTS:

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering hangers and supports which may be incorporated in the work include, but are not limited to the following:
 - 1. Anvil
 - 2. C & S Mfg. Corp.
 - 3. Carpenter and Patterson, Inc.
 - 4. Elcen Metal Products Co.
 - 5. F & S Central Mfg. Corp.
 - 6. Fee & Mason Mfg. Co., Div. of A-T-O, Inc.
 - 7. ITT Grinnel Corp.

PART 3 - EXECUTION

3.1 INSTALLATION OF HANGERS AND SUPPORTS:

- A. General: Install hangers, supports, clamps and attachments to support piping properly from building structure; comply with MSS SP-69. Install supports with maximum of eight foot spacing. Building attachments and/or hangars systems shall be cast in place into the concrete post tension slab system during concrete placement. Refer to Drawings for additional notes. Do not use wire or perforated metal to support piping, and do not support piping from other piping, ductwork or other supported mechanical or electrical items.
- B. Install hangers and supports complete with necessary inserts, bolts, rods, nuts, washers and other accessories. Except as otherwise indicated for exposed continuous pipe runs, install hangers and supports of same type and style as installed for adjacent similar piping.
- C. Prevent electrolysis in support of copper tubing by use of hangers and supports which

are copper plated, or by other recognized industry methods.

- D. Pipe Slopes: Install hangers and supports to provide indicated pipe slopes.
- E. Insulated Piping: Comply with the following installation requirements.
- F. Clamps: Attach clamps, including spacers (if any), to piping with clamps projecting through insulation; do not exceed pipe stresses allowed by ANSI B31.
- G. Saddles: Where insulation without vapor barrier is indicated, install protection saddles.

END OF 220529

220533 - IDENTIFICATION FOR DOMESTIC PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 DESCRIPTION OF WORK:

- A. Extent of mechanical identification work required by this sections indicated on drawings and/or specified in other Division 23 sections. Systems which must be identified are as follows:
 - 1. Water Heaters
 - 2. Domestic Hot Water Systems
 - 3. Natural Gas Piping
- B. Type of identification devices specified in this section include the following:
 - 1. Engraved Plastic-Laminate Signs
 - 2. Pipe Identification

1.2 SUBMITTALS

A. Product Data: Submit product specifications and installation instructions for each identification material and device required.

PART 2 - PRODUCTS

- 2.1 IDENTIFICATION MATERIALS:
 - A. PIPE STENCILING
 - 1. Provide stenciled markers and arrows indicating direction of flow on all piping installed under this Contract after the piping has been painted. Markers and arrows shall be painted on the piping using machine cut stencils. All letters shall be sprayed using fast drying lacquer paint. All markers and arrows shall be properly oriented so that descriptive name may be easily read from the floor.
 - B. VALVE TAGS:
 - 1. Provide the following:
 - a. Brass Valve Tags: Provide 19 gauge polished brass valve tags with stamp engraved piping system abbreviation in ¹/₄" high letters and

sequenced valve numbers $\frac{1}{2}$ " high, and with $\frac{5}{32}$ " hole for fastener. Provide $\frac{1}{2}$ " diameter tags, except as otherwise indicated.

b. Valve Tag Fasteners: Manufacturer's standard solid brass chain (wire link or headed type), or solid brass S-hooks of the sizes required for proper attachment of tags to valves, and manufactured specifically for that purpose.

C. ENGRAVED PLASTIC-LAMINATE SIGNS:

1. General: Provide engraving stock melamine plastic laminate, complying with FS L-P-387, in the sizes and thicknesses indicated, engraved with engraver's standard letter style of the sizes and wording indicated, black with white core (letter color) except as otherwise indicated, punched for mechanical fastening except where adhesive mounting is necessary because of substrate. Thickness: 1/16" for units up to 20 sq. in. or 8" length; 1/8" for larger units. Fasteners: Self-tapping stainless steel screws, expect contact-type permanent adhesive where screws cannot or should not penetrate the substrate.

2.2 LETTERING AND GRAPHICS:

A. General: Coordinate names, abbreviations and other designations used in mechanical identification work, with corresponding designations shown, specified or scheduled. Provide numbers, lettering and wording as indicated or, if not otherwise indicated, as recommended by manufacturer's or as required for proper identification and operation/maintenance of mechanical systems and equipment. Lettering in no case shall be less than 1/2" in height.

PART 3 - EXECUTION

3.1 APPLICATION AND INSTALLATION:

- A. PIPING & VALVING:
 - 1. Coordination: Where identification is to be applied to surfaces which require insulation, painting or other covering or finish, including valve tags in finished mechanical spaces, install identification after completion of covering and painting. Install identification prior to installation of acoustical ceilings and similar removable concealment.
 - 2. Locate pipe markers as follows wherever piping is exposed to view in occupied spaces, machine rooms, accessible maintenance spaces (shafts, tunnels, plenums), exterior exposed locations and above removable acoustical ceilings.

- a. Near each valve and control device.
- b. Near locations where pipes pass through walls or floors/ceilings, or enter nonaccessible enclosures.
- c. Near major equipment items and other points of origination and termination.
- d. Spaced intermediately at maximum spacing of 50' along each piping run, except reduce spacing to 25' in congested areas of piping and equipment.
- 3. Valve Identification General: Provide valve tag on every valve, cock and control device in each piping system listed under the paragraph entitled "DESCRIPTION OF WORK"; exclude check valves, valves within factory-fabricated equipment units, and shut-off or isolation valves at equipment. List each tagged valve in valve schedule for each piping system.
- 4. Mount valve schedule frames and schedules in machine rooms where indicated or, if not otherwise indicated, where directed by the Architect/Engineer.
- 5. Do not use plastic piping markers where located in a return air plenum.

3.2 PIPE PAINTING AND IDENTIFICATION

- A. Piping shall be required to be painted and identified as follows:
 - 1. Domestic Hot Water: Black Letters on Yellow or White Background: "DOM. HOT "
 - 2. Natural Gas Piping: Yellow Letters on a Green Background: "N.GAS"
- 3.3 PLUMBING EQUIPMENT:
 - A. Mechanical Equipment Identification, General: Install engraved plastic laminate sign on or near each major item of mechanical equipment and each operational device, as specified herein.
 - 1. Water Heaters

END OF 220533
220700 - PLUMBING INSULATION

PART 1 - GENERAL

- 1.1 DESCRIPTION OF WORK:
 - A. Extent of mechanical insulation required by this section is indicated on drawings, and by requirements of this section.
 - B. Types of mechanical insulation specified in this section include the following:
 - 1. Piping System Insulation:
 - a. Domestic Cold Water Lines
 - b. Hot Water & Circulating Hot Water Lines
 - c. Lavatory P-Trap and Supplies

1.2 QUALITY ASSURANCE:

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products which may be incorporated in the work include, but are not limited to the following:
 - 1. Armaflex
 - 2. Armstrong World Industries, Inc.
 - 3. Babcock & Wilcox Co., Insulating Products Div.
 - 4. Certainteed Corp.
 - 5. Johns-Manville Corp.
 - 6. Keene Corp.
 - 7. Knauf Fiber Glass
 - 8. Owens-Corning Fiberglass Corp.
- B. Flame/Smoke Ratings: Provide composite mechanical insulation (insulation, jackets, coverings, sealers, mastics and adhesives) with flame-spread rating of 25 or less, and smoke-developed rating of 50 or less, as tested by ANSI/ASTM E 84 (NFPA 255) method.

1.3 INSULATION SHIELDS

A. Metal insulation shields are required at all pipe hangers where the piping is insulated. Metal shields shall be constructed of galvanized steel, formed to a 180 degree arc with lengths equal to at least twice the pipe diameter.

1.4 SUBMITTALS:

- A. Product Data: Submit manufacturer's specifications and installation instructions for each type of mechanical insulation. Submit schedule showing manufacturer's product number, thickness, and furnished accessories for each mechanical system requiring insulation.
- B. Certified Tests: With product data submit certified test reports on performances including burning characteristics and thermal insulating valves.
- 1.5 DELIVERY, STORAGE AND HANDLING:
 - A. Deliver insulation, coverings, cements, adhesives, and coatings to site in containers with manufacturer's stamp or label, affixed showing fire hazard ratings of products.
 - B. Protect insulation against dirt, water, and chemical and mechanical damage. Do not install damaged insulation; remove damaged insulation from project site.

PART 2 - PRODUCTS

- 2.1 PIPING INSULATION: <u>Piping Insulation</u>:
 - A. All hot water, horizontal storm leaders, and domestic water piping shall be insulated. The insulation shall be a heavy density, pipe insulation with a K factor .22 at 75°F mean temperature. The insulation shall be wrapped with a vapor barrier jacket with selfsealing lap, equal to Certain-teed, Mansville, Owens-Corning. Cover fittings with Zeston or equal premolded insulating fittings. Insulation shall be installed in a professional, neat appearing manner; poor workmanship shall be corrected at the Contractor's expense.
 - B. Application <u>thicknesses</u> shall be as follows:

Domestic hot and recirc. hot water piping:	1" thick
Domestic cold water piping:	1/2" thick

C. Lavatory P-traps and supplies shall be insulated with 1/2" premolded fiberglass "Trapwrap" with integral plastic white jacket.

PART 3 - EXECUTION

- 3.1 INSTALLATION OF INSULATION:
 - A. General: Install insulation products in accordance with manufacturer's written instructions, and in accordance with recognized industry practices to ensure that

insulation serves its intended purpose.

- B. Install insulation materials with smooth and even surface. Insulate each continuous run of piping or ductwork with full-length units of insulation, with single cut piece to complete run. Do not use cut pieces or scraps abutting each other.
- C. Clean and dry all surfaces prior to insulating. Butt insulation joints firmly together to ensure complete and tight fit over surfaces to be covered.
- D. Cover valves, fittings and similar items in each piping system with equivalent thickness and composition of insulation as applied to adjoining pipe run. Install factory molded, precut or job fabricated units (at Installer's option) except where specific form or type is indicated.
- E. Maintain integrity of vapor-barrier jackets on pipe insulation, and protect to prevent puncture or other damage.
- F. Extend piping insulating without interruption through walls, floors and similar piping penetrations, except where otherwise indicated.
- G. Install protective metal shields and insulated inserts wherever needed to prevent compression of insulation. Pipe Hanger Insulation Inserts: Butt pipe insulation against pipe hanger insulation inserts. For cold piping apply wet coat of vapor barrier lap cement on butt joints and seal joints with 3 inch wide vapor barrier tape or band.

3.2 PROTECTION AND REPLACEMENT:

- A. Replace damaged insulation which cannot be repaired satisfactorily, including units with vapor barrier damage and moisture saturated units.
- B. Protection: Insulation Installer shall advise Contractor of required protection for insulation work during remainder of construction period, to avoid damage and deterioration.

END OF 220700

221116 - DOMESTIC WATER PIPING

PART 1 - GENERAL

1.1 DESCRIPTION OF WORK:

- A. Extent of domestic water piping required by this section is indicated on drawings and/or specified in other Division 22 sections or as required to provide a complete system.
- 1.2 QUALITY ASSURANCE:
 - A. Plumbing Code Compliance: Comply with Kentucky State Plumbing Code and pertaining to plumbing materials, construction and installation of products. Also comply with all state and local codes having jurisdiction. No work shall begin until the Contractor has approved plumbing plans. The Contractor is responsible for installing the indicated systems in accordance with code, therefore any modifications to the project required by the Division of Plumbing shall be considered as part of this project and shall be made at no increase in contract price.
- 1.3 DELIVERY STORAGE, AND HANDLING:
 - A. Where possible, store pipe and tube inside and protected from weather. Where necessary to store outside, elevate above grade and enclose with durable, waterproof wrapping. Maintain end-caps through shipping, storage and handling as required to prevent pipe-end damage and eliminate dirt and moisture from inside of pipe and tube.
 - B. Protect flange and fittings from moisture and dirt by inside storage and enclosure, or by packaging with durable, waterproof wrapping.
- 1.4 SUBMITTALS:
 - A. Product Data: Submit catalog cuts, specifications, installation instructions, and dimensioned drawings for each type of valve, specialty, etc. Include pressure drop curve or chart for each type and size of equipment.

PART 2 - PRODUCTS

2.1 PLUMBING PIPING MATERIALS:

- A. All piping for hot and cold water above the slab, within the building, shall be type "L" hard temper copper tube with wrought copper fittings and soldered connections made up with lead free solder equal in performance to 95/5 solder.
- B. All piping for cold water below the slab shall be type "K" hard temper copper tube with

wrought copper fittings and soldered connections made up with lead free solder equal in performance to 95/5 solder.

PART 3 - EXECUTION

3.1 PIPING INSTALLATION;

- A. Pipe shall be accurately cut from job measurements and shall be neatly aligned, securely connected, and properly supported. Piping shall be thoroughly cleaned before installation. Provide pipe sleeves where piping passes through structure. Threaded and soldered joints shall be made in a workmanlike manner according to good pipe fitting practices.
- B. Locate piping runs, except as otherwise indicated, vertically and horizontally (pitched to drain) and avoid diagonal runs wherever possible. Orient horizontal runs parallel with walls and column lines. Locate runs as shown or described by diagrams, details and notations or, if not otherwise indicated, run piping in shortest route which does not obstruct usable space or block access for servicing building and its equipment. Hold piping close to walls, overhead construction, columns and other structural and permanent-enclosure elements of building; limit clearance to 1/2" where furring is shown for enclosure or concealment of piping, but allow for insulation thickness, if any. Where possible, locate insulated piping for 1.0" clearance outside insulation. Wherever possible in finished and occupied spaces, conceal piping from view, by locating in column enclosures, in hollow wall construction or above suspended ceilings; do not encase horizontal runs in solid partitions, except as indicated.
- C. Electrical Equipment Spaces: Do not run piping through transformer vaults, over panels and other electrical or electronic equipment spaces and enclosures.
- D. Braze copper tube-and-fitting joints where indicated, in accordance with ANSI B31.
- E. Solder copper tube-and-fitting joints where indicated, in accordance with recognized industry practice. Cut tube ends squarely, ream to full inside diameter, and clean outside of tube ends and inside of fittings. Apply solder flux to joint areas of both tubes and fittings. Insert tube full depth into fitting, and solder in manner which will draw solder full depth and circumference of joint. Wipe excess solder from joint before it hardens.
- F. Install valves where required for proper operation of piping and equipment, including valves in branch lines where necessary to isolate sections of piping. Locate valves so as to be accessible and so that separate support can be provided when necessary. Install shut-off valves for each piece of plumbing equipment.
- G. Install valves with stems pointed up, in vertical position where possible, but in no case with stems pointed downward for horizontal plane unless unavoidable. Install valve drains with hose end adapter for each valve that must be installed with stem below horizontal

plane.

- H. Ferrous pipe hangers shall be Fee & Mason Figure 215 or equal Unistrut malleable iron split ring hanger; copper pipe hangers shall be Figure 361 cast brass with plated adjuster. No perforated strap iron hangers will be permitted. Fee & Mason #400 "Auto-Grip" type hangers are an acceptable alternative hanger. Concrete inserts, where required, shall be Unistrut, Midwest, or Truscon. Hangers shall be spaced at ten foot intervals or less, as required to avoid sag, prevent vibration, and allow accurate leveling or grading. Vertical piping shall be supported by Fee & Mason Figure 241 or equal clamp for ferrous piping, and Figure 368 for copper. Provide sheet metal saddles for insulated piping.
- I. Do not use wire or perforated metal to support piping, and do not support piping from other piping, ductwork or other supported mechanical or electrical items. Install hangers and supports to provide indicated pipe slopes.

3.2 AIR CHAMBERS AND TRAPS:

A. Wherever water piping terminates at a fixture or valve, furnish and install air chambers of sufficient capacity to prevent water hammer. Length shall be at least 12 times branch pipe diameter. Every fixture shall be separately trapped with a water sealed trap installed as close to the fixture as possible.

3.3 PIPING STERILIZATION:

A. Sterilize the new hot and cold water piping system with solution containing not less than 50 PPM available chlorine. Solution shall remain in the system a minimum of 24 hours, with each valve being operated several times during the period. After completion, flush system with city water until chlorine residual is lowered to incoming city water level.

3.4 TESTING:

- A. All water piping shall be tested with 50 PSI hydrostatic pressure; isolate piping from boiler prior to testing. All piping shall be tested before any insulation installed, and shall be subject to the above pressure for an uninterrupted period of not less than 4 hours. All lines, joints, flanges, valve stems, etc., shall be leak tight.
- B. General: Provide temporary equipment for testing, including pump and gages. Test piping system before insulation is installed. Remove control devices before testing.
- C. Observe each test section for leakage at end of test period. Test fails if leakage is observed or if pressure drop exceeds 5% of test pressure.
- D. Repair piping systems sections which fail required piping test, by disassembly and reinstallation, using new materials to extent required to overcome leakage. Do not use

chemicals, stop-leak compounds, mastics, or other temporary repair methods.

END OF 221116

221119 -: DOMESTIC WATER PIPING SPECIALTIES

PART 1 - GENERAL

1.1 DESCRIPTION OF WORK:

- A. Extent of piping specialties required by this section is indicated on drawings and/or specified in other Division 22 sections or as required to provide a complete system.
- B. Types of piping specialties specified in this section include the following:
 - 1. Wall Hydrants
 - 2. Backflow Preventer
 - 3. Pipe Escutcheons
 - 4. Pipeline Strainers.
 - 5. Dielectric Unions.
 - 6. Sleeves.

1.2 QUALITY ASSURANCE:

- A. Plumbing Code Compliance: Comply with Kentucky State Plumbing Code and pertaining to plumbing materials, construction and installation of products. Also comply with all state and local codes having jurisdiction. No work shall begin until the Contractor has approved plumbing plans. The Contractor is responsible for installing the indicated systems in accordance with code, therefore any modifications to the project required by the Division of Plumbing shall be considered as part of this project and shall be made at no increase in contract price.
- B. Manufacturers: Firms regularly engaged in manufacturer of piping specialties of types and sizes required, whose products have been in satisfactory use in similar service for not less than 5 years.

1.3 SUBMITTALS:

- A. Product Data: Submit catalog cuts, specifications, installation instructions, Also submit dimensioned drawings for pipeline strainers. Include pressure drop curve or chart for each type and size of pipeline strainer. Submit schedule showing manufacturer's figure number, size, location and features for each required pipeline strainer.
- B. Maintenance Data: Submit maintenance data and spare parts lists for each type of pipeline strainer. Include this data in Maintenance Manual.

PART 2 - PRODUCTS

2.1 MANUFACTURED PIPING SPECIALTIES:

- A. General: Provide factory-fabricated piping specialties recommended by manufacturer for use in service indicated. Provide piping specialties of types, pressure ratings, voltage and wattage indicated for each service, or if not indicated, provide proper selections as determined by Engineer to comply with installation requirements. Provide sizes as indicated, and connections, which properly interface with pipe, tube, and equipment connections. Where more than one type is indicated, selection is Installer's option.
- B. Hose Valves: American-Standard #4224.028 with screw-on vacuum breaker and 3/4" hose thread outlet.
- C. Wall Hydrants: Wall hydrants shall be Jay R. Smith #5609-PB "non-freeze", cast bronze, polished bronze face, with integral vacuum breaker, ³/₄" hose connection, removable key handle operator; or equal Josam, Wade, or Zurn. Provide accessible stop valve inside building.
- D. Backflow Preventer: This contractor shall furnish and install a reduced pressure backflow preventer or a double check valve assembly, at the water service entrance, and where else indicated on the Drawings. Reduced pressure type valves to have relief chamber piped floor drain or through exterior wall. Backflow preventer assembly to be equal to Watts #LF709 or approved equal Wilkins, double check valve type interim relief chamber, bronze body, trim, and bronze ball valve shut-offs on inlet and outlet. Lead Free.
- E. Pipe Escutcheons, General: Provide pipe escutcheons as specified herein with inside diameter closely fitting pipe outside diameter, or outside of pipe insulation where pipe is insulated. Select outside diameter of escutcheon to completely cover pipe penetration hole in floors, walls, or ceilings, and pipe sleeve extension, if any. Furnish pipe escutcheons with nickel or chrome finish for occupied areas, prime paint finish for unoccupied areas.
 - 1. Pipe Escutcheons for Moist and Wet Areas: For waterproof floors, and areas where water and condensation can be expected to accumulate provide cast brass or sheet brass escutcheons, solid or split hinged.
 - 2. Pipe Escutcheons for Dry Areas: Provide sheet steel escutcheons, solid or split hinged.
- F. Low Pressure Y-Type Pipeline Strainers, General: Comply with FCI 73-1. Provide

strainers full line size of connecting piping, with ends matching piping system materials. Select strainers for 125 psi working pressure with Type 304 stainless steel screens, with 3/64" performance at 233 per sq. in.

- 1. Threaded Ends, 2" and Smaller: Cast-iron body, screwed screen retainer with centered blowdown fitted with pipe plug.
- 2. Threaded Ends, 2¹/₂" and Larger: Cast-iron body, bolted screen retainer with offcenter blowdown fitted with pipe plug.
- 3. Flanged Ends, 2¹/₂" and Larger: Cast-iron body, bolted screen retainer with offcenter blowdown fitted with pipe plug.
- 4. Available Manufacturers: Subject to compliance with requirements, manufacturers offering low pressure Y-type strainers which may be incorporated in the work include, but are not limited to the following:
 - a. American Air Filter, an Allis-Chalmers Co.
 - b. Armstrong Machine Works.
 - c. Hoffman Specialty, ITT Fluid Handling Div.
 - d. Metraflex Co.
 - e. Sarco Co., Div. of White Consolidated.
 - f. Crane Co.
 - g. Trerice (H.O.) Co.
 - h. Victaulic Co. of America
- G. Dielectric Unions, General: Provide standard products recommended by manufacturer for use in service indicated, which effectively isolate ferrous from non-ferrous piping (electrical conductance), prevent galvanic action, and stop corrosion. Universal Controls or equal
 - 1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering dielectric unions which may be incorporated in the work include, but are not limited to the following:
 - a. Atlas Products Co.
 - b. Capital Mfg. Co., Div. of Harsco Corp.
 - c. Eclipse, Inc.
 - d. Epco Sales, Inc.
 - e. FMC Corp.
 - f. McNally, Inc.
 - g. PSI Industries.
 - h. Stockham Valves and Fittings.

i. Universal Controls

2.2 FABRICATED PIPING SPECIALTIES:

- A. Pipe Sleeves: Provide pipe sleeves of one of the following:
 - 1. Sheet-Metal: Fabricate from galvanized sheet metal; round tube closed with snaplock joint, welded spiral seams or welded longitudinal joint. Fabricate from the following gages: 3" and smaller, 20 gage; 4" to 6", 16 gage; over 6", 14 gage.
 - a. Steel-Pipe: Fabricate from Schedule 40 galvanized steel pipe; remove burrs.
 - b. Iron-Pipe: Fabricate from cast-iron or ductile-iron pipe, remove burrs.

PART 3 - EXECUTION

- 3.1 INSTALLATION OF MANUFACTURED PIPING SPECIALTIES:
 - A. Pipe Escutcheons: Install pipe escutcheons on each pipe penetration thru floors, walls, partitions, and ceilings where penetration is exposed to view; and on exterior of building. Secure escutcheon to pipe or insulation so escutcheon covers penetration hole and is flush with adjoining surface
 - B. Wall Hydrants: Install as indicated on the Drawings in accordance with manufacturer's recommendations.
 - C. Dielectric Unions: Install at each piping joint between ferrous and non-ferrous piping. Comply with manufacturer's installation instructions.
 - D. Y-Type Strainers: Install Y-type strainers, full size of pipe line, in accordance with manufacturer's installation instructions. Install pipe nipple and shutoff valve in strainer blow down connection, full size of connection. Where indicated, provide drain line from shutoff valve to plumbing drain, full size of blow down connection.
 - E. Locate Y-type strainers in supply line ahead of the following equipment, and elsewhere as indicated, if integral strainer is not included in equipment, or if suction diffuser is not indicated.

3.2 INSTALLATION OF FABRICATED PIPING SPECIALTIES:

A. Sleeves: Install pipe sleeves of type indicated where piping passes through walls,

floors, ceilings and roofs. Do not install sleeves through structural members of work, except as detailed on drawings, or as reviewed by Architect/Engineer. Install sleeves accurately centered on pipe runs. Size sleeves so that piping and insulation (if any) will have free movement in sleeve, including allowance for thermal expansion; but not less than 2 pipe sizes larger than piping run. Where insulation includes vapor-barrier jacket, provide sleeve with sufficient clearance for installation.

- 1. Install sheet-metal sleeves at interior partitions and ceilings other than suspended ceilings.
- 2. Install iron-pipe sleeves at exterior penetrations, both above and below grade.
- 3. Install steel-pipe or plastic-pipe sleeves except as otherwise indicated.

3.3 SPARE PARTS:

A. Furnish to Owner, with receipt, one valve key for each key operated hydrant, bibb, or faucet installed.

END OF 221119

221123 - NATURAL GAS PIPING SYSTEMS

PART 1 - GENERAL

1.1 DESCRIPTION OF WORK:

- A. Extent of domestic water piping required by this section is indicated on drawings and/or specified in other Division 22 sections or as required to provide a complete system.
- 1.2 QUALITY ASSURANCE:
 - A. Plumbing Code Compliance: Comply with Kentucky State Plumbing Code and pertaining to plumbing materials, construction and installation of products. Also comply with all state and local codes having jurisdiction. No work shall begin until the Contractor has approved plumbing plans. The Contractor is responsible for installing the indicated systems in accordance with code, therefore any modifications to the project required by the Division of Plumbing shall be considered as part of this project and shall be made at no increase in contract price.
- 1.3 DELIVERY STORAGE, AND HANDLING:
 - A. Where possible, store pipe and tube inside and protected from weather. Where necessary to store outside, elevate above grade and enclose with durable, waterproof wrapping. Maintain end-caps through shipping, storage and handling as required to prevent pipe-end damage and eliminate dirt and moisture from inside of pipe and tube.
 - B. Protect flange and fittings from moisture and dirt by inside storage and enclosure, or by packaging with durable, waterproof wrapping.
- 1.4 SUBMITTALS:
 - A. Product Data: Submit catalog cuts, specifications, installation instructions, and dimensioned drawings for each type of valve, specialty, etc. Include pressure drop curve or chart for each type and size of equipment.

PART 2 - PRODUCTS

- 2.1 BASIC IDENTIFICATION:
 - A. Building Distribution Piping: Plastic pipe markers.
 - B. Gas Valves: Brass valve tags.
- 2.2 BASIC PIPE, TUBE AND FITTINGS:
 - A. Exterior Gas Piping:

- 1. All Pipe Sizes: Galvanized steel pipe, Schedule 40 with Wrought-steel, threaded fittings.
- B. Underground Exterior Gas Service Piping:
 - 1. Pipe Sizes ¹/₂" Through 4": Thermoplastic gas pressure pipe, tubing, and fittings complying with ANSI/ASTM D 2513. All joining methods shall be as approved by the International Mechanical Code and Kentucky State Code Revisions. All underground thermoplastic pipe shall be provided with No. 18 AWG copper tracer wire with yellow insulation.
- C. Building Distribution Piping:
 - 1. Pipe Size 2" and Smaller: Black steel pipe, Pipe Weight: Schedule 40 with Malleable iron threaded fittings.
 - 2. Pipe Size 2¹/₂" and Larger: Black steel pipe, Schedule 40 with Wrought-steel buttwelded fittings.
- 2.3 SPECIAL VALVES
 - A. Gas Cocks 2" and Smaller: 150 PSI non-shock WOG, bronze straightway cock, flat or square head, threaded ends.
 - B. Gas Cocks 2¹/₂" and Larger: 125 PSI non-shock WOG, iron body bronze mounted, straightway cock, square head, flanged ends.

PART 3 - EXECUTION

- 3.1 INSTALLATION OF NATURAL GAS PIPING:
 - A. Use sealants on metal gas piping threads which are chemically resistant to natural gas. Use sealants sparingly, and apply to only male threads of metal joints.
 - B. Remove cutting and threaded burrs before assembling piping.
 - C. Do not install defective piping or fittings. Do not use pipe with threads which are chipped, stripped or damaged.
 - D. Plug each gas outlet, including valves, with threaded plug or cap immediately after installation and retain until continuing piping, or equipment connection are completed.
 - E. Ground gas piping electrically and continuously within project, and bond tightly to grounding connection.

- 3.2 Install drip-legs in gas piping where indicated, and where required by code or regulation.
 - A. Install "Tee" fitting with bottom outlet plugged or capped, at bottom of pipe risers.
 - B. Use dielectric unions where dissimilar metals are joined together.
 - C. Install piping with 1" drop in 60' pipe run (0.14%) in direction of floor.
- 3.3 EQUIPMENT CONNECTIONS:
 - A. General: Connect gas piping to each gas-fired equipment item, with drip leg and shutoff gas cock. Comply with equipment manufacturer's instructions.
- 3.4 PIPING TESTS:
 - A. Test natural gas piping in accordance with ANSI B31.2, and local utility requirements.

END OF 221123

221316 - SANITARY WASTE AND VENT PIPING

PART 1 - GENERAL

1.1 DESCRIPTION OF WORK:

A. Extent of sanitary waste and vent piping required by this section is indicated on drawings and/or specified in other Division 22 sections or as required to provide a complete system.

1.2 QUALITY ASSURANCE:

A. Plumbing Code Compliance: Comply with applicable portions of Kentucky State Plumbing Code and pertaining to plumbing materials, construction and installation of products. Also comply with all state and local codes having jurisdiction. No work shall begin until the Contractor has approved plumbing plans. The Contractor is responsible for installing the indicated systems in accordance with code, therefore any modifications to the project required by the Division of Plumbing shall be considered as part of this project and shall be made at no increase in contract price.

PART 2 - PRODUCTS

- 2.1 PLUMBING PIPING MATERIALS:
 - A. Soil and waste: Piping materials to be as below for the indicated areas.
 - 1. Soil and waste piping may be Schedule 40 PVC and pipe fittings, or hub service weight cast iron with sealed fittings.
 - B. Plumbing Vents: <u>All vent piping to cast iron no-hub or DWV copper</u> where located above lay-in ceilings in the return air plenum. Vent piping concealed in walls may be Schedule 40 PVC and pipe fittings, or cast iron no hub; however piping must transition once it exits the wall cavity to non-PVC material.
 - C. Condensate Waste: Condensate waste piping may be Schedule 40 PVC, unless piping must travel through a return air plenum, in which it should be Type M copper.

2.2 CLEANOUTS

A. All **floor cleanouts** shall be Jay R. Smith #4051 series, coated cast iron, with square Nikaloy top, hub outlet with gasket, of sizes required. It shall be the responsibility of this contractor to determine the type of floor covering to be used at each cleanout location, and to rough-in and install each cleanout flush with the finished floor construction.

- B. All **wall cleanouts** shall be Jay R. Smith #4472 series, with round stainless steel access cover, center screw and recessed bronze tapped plug, of sizes required.
- C. All **cleanouts for installation exterior to the building** where required by the drawings or code, shall be Jay R. Smith #4237-U, full size of line, cast iron, hub outlet, heavy duty round cast iron tractor cover with vandal proof screw.
- D. Approved equivalent Josam, Zurn, or Wade is acceptable.

PART 3 - EXECUTION

- 3.1 PIPING INSTALLATION;
 - A. Pipe shall be accurately cut from job measurements and shall be neatly aligned, securely connected, and properly supported. Piping shall be thoroughly cleaned before installation. Joints shall be made in a workmanlike manner according to good pipe fitting practices.
 - B. Locate piping runs, except as otherwise indicated, vertically and horizontally (pitched to drain) and avoid diagonal runs wherever possible. Locate runs as shown or described by diagrams, details and notations or, if not otherwise indicated, run piping in shortest route which does not obstruct usable space or block access for servicing building and its equipment.
 - C. Do not use wire or perforated metal to support piping, and do not support piping from other piping, ductwork or other supported mechanical or electrical items. Install hangers and supports to provide indicated pipe slopes.

3.2 CLEANOUTS:

- A. Cleanouts shall be installed at points as noted on the drawings, as well as at the foot of each soil, waste or interior downspout stack, minimum every 80 feet in horizontal soil and waste lines, and at other points as required for easy system maintenance. Cleanouts shall be full size of the pipe up to 4", and 4" size for pipe above 4" size. Grease all cleanout plugs.
- B. Cleanouts and/or test tees concealed in inaccessible pipe spaces, walls and other locations shall have an eight (8) inch by eight (8) inch (minimum) access panel or cover plates shall be set flush with finished floors and walls and shall be key or screw driver operable.
- C. Access panels for cleanouts shall be of the Zurn, 1460 series or equivalent by Josam or Wade. Where they are not to receive paint, they shall be polished bronze unless otherwise indicated where they are to receive paint or other finishes. They may, at the Contractor's

option, be Perma-Coated steel, prepared to receive finish.

- D. Cleanouts and access panels shall be sized so as to permit the entry of a full sized rodding head capable of one hundred percent circumferential coverage of the line served.
- E. Provide a non-hardening mixture of graphite and grease on threads of all screwed cleanouts during installation.
- F. Do not install cleanouts against walls, partitions, etc. where rodding will be difficult or impossible. Extend past the obstruction. Hold a minimum of 12" from all walls.
- G. In finished walls, floors, etc., insure that cleanouts are installed flush with finished surfaces and, where required, grout or otherwise finish in a neat and workmanlike manner.

3.3 FLOOR DRAINS

- A. Provide floor drains at locations indicated and/or as required by Kentucky Building Code. Install in a neat and workmanlike manner. Coordinate locations with appropriate persons or party to insure floor pitch to drain where required.
- B. Each floor drain located on floors above the lowest floor shall to provided complete with flashing and clamping collar.
- C. Ensure by coordination with the appropriate persons or party that spaces served by a floor drain(s) has a water seal extending at least three (3) inches from the floor of the space served on all floors above the lowest level.
- D. The floor drains shall be Zurn, Josam, Wade, Ancon or equivalent, as specified on the Drawings.

3.4 TESTING:

- A. All waste piping shall be tested with all stacks filled with water, and any other tests required by the Plumbing Inspector. All lines, joints, flanges, etc., shall be leak tight.
- B. Repair piping systems sections which fail required piping test, by disassembly and reinstallation, using new materials to extent required to overcome leakage.
- C. Drain test water from piping systems after testing and repair work has been completed.

END OF 221316

SECTION 221513 - GENERAL-SERVICE COMPRESSED-AIR PIPING

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes piping and related specialties for general-service compressed-air systems operating at 125 psig or less.
- B. See Section 221519 "General-Service Packaged Air Compressors and Receivers" for generalservice air compressors and accessories.

1.2 ACTION SUBMITTALS

- A. Product Data: For the following:
 - 1. Pressure regulators. Include rated capacities and operating characteristics.
 - 2. Automatic drain valves.

1.3 CLOSEOUT SUBMITTALS

- A. Operation and maintenance data.
- 1.4 QUALITY ASSURANCE
 - A. ASME Compliance: Comply with ASME B31.9, "Building Services Piping," for low-pressure compressed-air piping.

PART 2 - PRODUCTS

- 2.1 PIPES, TUBES, AND FITTINGS
 - A. Steel Pipe: ASTM A 53/A 53M, Type E or S, Grade B, black with ends threaded according to ASME B1.20.1.
 - 1. Steel Nipples: ASTM A 733, made of ASTM A 53/A 53M or ASTM A 106, Schedule 40, galvanized seamless steel pipe. Include ends matching joining method.
 - 2. Malleable-Iron Fittings: ASME B16.3, Class 150 or 300, threaded.
 - 3. Malleable-Iron Unions: ASME B16.39, Class 150 or 300, threaded.
 - 4. Steel Flanges: ASME B16.5, Class 150 or 300, carbon steel, threaded.
 - 5. Wrought-Steel Butt-Welding Fittings: ASME B16.9, Schedule 40.
 - 6. Steel Flanges: ASME B16.5, Class 150 or 300, carbon steel.

B. Transition Couplings for Metal Piping: Metal coupling or other manufactured fitting same size as, with pressure rating at least equal to and ends compatible with, piping to be joined.

2.2 JOINING MATERIALS

- A. Pipe-Flange Gasket Materials: Suitable for compressed-air piping system contents.
 - 1. ASME B16.21, nonmetallic, flat, full-face, asbestos free, 1/8-inch (3.2-mm) maximum thickness.

2.3 VALVES

A. Metal Ball, Butterfly, Check, Gate, and Globe Valves: Comply with requirements in Section 220523 "General-Duty Valves for Plumbing Piping."

2.4 DIELECTRIC FITTINGS

- A. General Requirements for Dielectric Fittings: Combination fitting of copper alloy and ferrous materials with insulating material; suitable for system fluid, pressure, and temperature. Include threaded, solder-joint, plain, or weld-neck end connections that match piping system materials.
- B. Dielectric Unions: Factory-fabricated union assembly, for 150-psig minimum working pressure.

2.5 SPECIALTIES

- A. Safety Valves: ASME Boiler and Pressure Vessel Code: Section VIII, "Pressure Vessels," construction; National Board certified, labeled, and factory sealed; constructed of bronze body with poppet-type safety valve for compressed-air service.
 - 1. Pressure Settings: Higher than discharge pressure and same or lower than receiver pressure rating.
- B. Air-Main Pressure Regulators: Bronze body direct acting, spring-loaded manual pressuresetting adjustment, and rated for 150-psig inlet pressure, unless otherwise indicated.
- C. Automatic Drain Valves: Stainless-steel body and internal parts, rated for 200-psig minimum working pressure, capable of automatic discharge of collected condensate.
- D. Coalescing Filters: Coalescing type with activated carbon capable of removing water and oil aerosols; with color-change dye to indicate when carbon is saturated and warning light to indicate when selected maximum pressure drop has been exceeded.

PART 3 - EXECUTION

3.1 PIPING APPLICATIONS

- A. Compressed-Air Piping between Air Compressors and Receivers: Use the following piping materials for each size range:
 - 1. NPS 2 and Smaller: Steel pipe; threaded, malleable-iron fittings; and threaded joints.
- B. Low-Pressure Compressed-Air Distribution Piping: Use the following piping materials for each size range:
 - 1. NPS 2 and Smaller: Steel pipe; threaded, malleable-iron fittings; and threaded joints.
- C. Drain Piping: Use the following piping materials:
 - 1. NPS 2 and Smaller: Type M copper tube; wrought-copper fittings; and brazed or soldered joints.

3.2 VALVE APPLICATIONS

- A. Comply with requirements in "Valve Applications" Article in Section 220523 "General-Duty Valves for Plumbing Piping."
- B. Equipment Isolation Valves: Safety-exhaust, copper-alloy ball valve with exhaust vent and pressure rating at least as great as piping system operating pressure.

3.3 PIPING INSTALLATION

- A. Drawing plans, schematics, and diagrams indicate general location and arrangement of compressed-air piping. Indicated locations and arrangements were used to size pipe and calculate friction loss, expansion, air-compressor sizing, and other design considerations. Install piping as indicated unless deviations to layout are approved on Coordination Drawings.
- B. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited, unless otherwise indicated.
- C. Install air and drain piping with 1 percent slope downward in direction of source.
- D. Install nipples, flanges, unions, transition and special fittings, and valves with pressure ratings same as or higher than system pressure rating, unless otherwise indicated.
- E. Install branch connections to compressed-air mains from top of main. Provide drain leg and drain trap at end of each main and branch and at low points.
- F. Install piping to permit valve servicing.
- G. Install piping free of sags and bends.

- H. Install fittings for changes in direction and branch connections.
- I. Install unions, adjacent to each valve and at final connection to each piece of equipment and machine.

3.4 JOINT CONSTRUCTION

- A. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.
- B. Remove scale, slag, dirt, and debris from pipe and fittings before assembly.
- C. Threaded Joints: Thread pipe with tapered pipe threads according to ASME B1.20.1. Apply appropriate tape or thread compound to external pipe threads.
- D. Flanged Joints: Use asbestos-free, nonmetallic gasket suitable for compressed air. Join flanges with gasket and bolts according to ASME B31.9 for bolting procedure.
- E. Dissimilar Metal Piping Material Joints: Use dielectric fittings.

3.5 VALVE INSTALLATION

- A. General-Duty Valves: Comply with requirements in Section 220523 "General-Duty Valves for Plumbing Piping."
- B. Install shutoff valves and unions or flanged joints at compressed-air piping to air compressors.
- C. Install shutoff valve at inlet to each automatic drain valve, filter, lubricator, and pressure regulator.
- D. Install check valves to maintain correct direction of compressed-air flow to and from compressed-air piping specialties and equipment.

3.6 DIELECTRIC FITTING INSTALLATION

A. Install dielectric unions in piping at connections of dissimilar metal piping and tubing.

3.7 FLEXIBLE PIPE CONNECTOR INSTALLATION

- A. Install flexible pipe connectors in discharge piping of each air compressor.
- B. Install stainless-steel-hose flexible pipe connectors in steel compressed-air piping.

3.8 SPECIALTY INSTALLATION

A. Install safety valves on receivers in quantity and size to relieve at least the capacity of connected air compressors.

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- B. Install air-main pressure regulators in compressed-air piping at or near air compressors.
- C. Install automatic drain valves on aftercoolers, receivers, and dryers. Discharge condensate onto nearest floor drain.
- D. Install coalescing filters in compressed-air piping at or near air compressors and upstream from mechanical filters.

3.9 HANGER AND SUPPORT INSTALLATION

- A. Comply with requirements in Section 220529 "Hangers and Supports for Plumbing Piping and Equipment" for pipe hanger and support devices.
- B. Vertical Piping: MSS Type 8 or 42, clamps.
- C. Individual, Straight, Horizontal Piping Runs:
 - 1. 100 Feet or Less: MSS Type 1, adjustable, steel clevis hangers.
- D. Base of Vertical Piping: MSS Type 52, spring hangers.
- E. Support horizontal piping within 12 inches of each fitting and coupling.
- F. Rod diameter may be reduced 1 size for double-rod hangers, with 3/8-inch minimum rods.
- G. Install hangers for Schedule 40, steel piping with the following maximum horizontal spacing and minimum rod diameters:
 - 1. NPS 1/4 to NPS 1/2: 96 inches with 3/8-inch rod.
 - 2. NPS 3/4 to NPS 1-1/4: 84 inches with 3/8-inch rod.
 - 3. NPS 1-1/2: 12 feet with 3/8-inch rod.
 - 4. NPS 2: 13 feet with 3/8-inch rod.
- H. Install supports for vertical, Schedule 40, steel piping every 15 feet (4.6 m).

3.10 FIELD QUALITY CONTROL

- A. Perform field tests and inspections.
- B. Tests and Inspections:
 - 1. Piping Leak Tests: Test new and modified parts of existing piping. Cap and fill generalservice compressed-air piping with oil-free dry air or gaseous nitrogen to pressure of 50 psig above system operating pressure, but not less than 150 psig. Isolate test source and let stand for four hours to equalize temperature. Refill system, if required, to test pressure; hold for two hours with no drop in pressure.
 - 2. Repair leaks and retest until no leaks exist.

END OF SECTION 221513

SECTION 221519 - GENERAL-SERVICE PACKAGED AIR COMPRESSORS AND RECEIVERS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

- 1. Lubricated, reciprocating air compressors.
- 2. Oil-flooded, rotary-screw air compressors.
- 3. Inlet-air filters.
- 4. Refrigerant compressed-air dryers.

1.2 SUBMITTALS

- A. Product Data: For each type of product indicated.1. Wiring Diagrams: For power, signal, and control wiring.
- B. Operation and maintenance data.

1.3 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. ASME Compliance: Fabricate and label receivers to comply with ASME Boiler and Pressure Vessel Code.

PART 2 - **PRODUCTS**

2.1 GENERAL REQUIREMENTS FOR PACKAGED AIR COMPRESSORS AND RECEIVERS

- A. General Description: Factory-assembled, -wired, -piped, and -tested; electric-motor-driven; air-cooled; continuous-duty air compressors, air dryers and receivers that deliver air of quality equal to intake air.
- B. Control Panels: Automatic control station with load control and protection functions. Comply with NEMA ICS 2 and UL 508.
 - 1. Enclosure: NEMA ICS 6, Type 12 control panel unless otherwise indicated.
 - 2. Motor Controllers: Full-voltage, combination magnetic type with undervoltage release feature and short-circuit protective device.
 - 3. Control Voltage: 120-V ac or less, using integral control power transformer.
 - 4. Starting Devices: Hand-off-automatic selector switch in cover of control panel, plus pilot device for automatic control.
- C. Receivers: Steel tank constructed according to ASME Boiler and Pressure Vessel Code: Section VIII, Division 1.
 - 1. Pressure Rating: At least as high as highest discharge pressure of connected compressors, and bearing appropriate code symbols.
 - 2. Interior Finish: Corrosion-resistant coating.

3. Accessories: Include safety valve, pressure gage, and drain.

D. REFRIGERANT COMPRESSED-AIR DRYERS

- 1. Description: Noncycling, air-cooled, electric-motor-driven unit with steel enclosure and capability to deliver 35 deg F, 100-psig air at dew point. Include automatic ejection of condensate from air-stream, step-down transformers, disconnect switches, inlet and outlet pressure gages, thermometers, automatic controls, and filters.
- E. Mounting Frame: Fabricate mounting and attachment to pressure vessel with reinforcement strong enough to resist packaged equipment movement during a seismic event when base is anchored to building structure.

PART 3 - EXECUTION

3.1 EQUIPMENT INSTALLATION

- A. Equipment Mounting: Install air compressors and air dryers on concrete bases using elastomeric pads. Comply with requirements in Division 03 Sections.
 - 1. Minimum Deflection: 1/8 inch.
- B. Install compressed-air equipment anchored to substrate.
- C. Install the following devices on compressed-air equipment:
 - 1. Pressure Gage, and Safety Valve: Install on each compressed-air receiver.
 - 2. Automatic Drain Valves: Install on aftercoolers, receivers, and dryers. Discharge condensate over nearest floor drain.

3.2 CONNECTIONS

- A. Comply with requirements for piping specified in Division 22 Section "General-Service Compressed-Air Piping." Drawings indicate general arrangement of piping, fittings, and specialties.
- B. Install piping adjacent to machine to allow service and maintenance.

END OF SECTION

SECTION 223300 - ELECTRIC WATER HEATERS

PART 1 - GENERAL

1.1 DESCRIPTION OF WORK:

- A. Extent of water heater work required by this section is indicated on drawings and schedules, and by requirements of this section.
- 1.2 QUALITY ASSURANCE:
 - A. Manufacturers: Firms regularly engaged in manufacturer of electric water heaters, of types and capacities required, whose products have been in satisfactory use in similar service for not less than 5 years.
 - B. ASME Compliance: Construct water heaters in accordance with American Society of Mechanical Engineers (ASME) Pressure Vessel Codes, where such requirements is indicated.
 - C. UL Labels: Provide electrical water heaters which have been listed and labeled by Underwriters Laboratories (UL).
- 1.3 PRODUCT DELIVERY, STORAGE, AND HANDLING:
 - A. Handle water heaters carefully to prevent damage, breaking, and scoring. Store heaters and equipment in clean dry place. Protect from weather, dirt, fumes, water, construction debris and physical damage.

PART 2 - PRODUCTS

- 2.1 DOMESTIC WATER HEATERS
 - A. Provide domestic electric water heaters as scheduled on the drawings.
 - B. Water heaters shall meet ASHRAE 90.1 and 90.1b energy efficiency standards.
 - C. Water heaters shall be provided with durable glass lining, with insulated water heater jacket. Integral thermostats shall be provided.
 - D. Tanks shall be provided with three (3) year minimum warranty.

END OF SECTION 223400

224000 - PLUMBING FIXTURES

PART 1 - GENERAL

1.1 DESCRIPTION OF WORK:

- A. Extent of plumbing fixture work required by this section is indicated on drawings and schedules, and by requirements of this section.
- 1.2 SUBMITTALS:
 - A. Product Data: Submit manufacturer's specifications for plumbing fixtures, equipment and trim, including catalog cut of each fixture type and trim item furnished, roughing-in dimensioned drawings, templates for cutting substrates, fixture carriers and installation instructions.

PART 2 - PRODUCTS

- 2.1 PLUMBING FIXTURES:
 - A. General: Provide factory-fabricated fixtures of type, style and material indicated. For each type fixture, provide fixture manufacturer's standard trim and valves as indicated by their published product information; either as designed and constructed, or as recommended by the manufacturer, and as required for a complete installation. Where type is not otherwise indicated, provide fixtures complying with governing regulations.
 - B. Fixtures shall be set firm and true, connected to all required piping services ready to use; all fixtures shall be left clean.

2.2 PLUMBING FITTINGS, TRIM AND ACCESSORIES:

- A. Water Outlets: At locations where water is supplied (by manual, automatic or remote control), provide commercial quality faucets, valves, or dispensing devices, of type and size indicated, and as required to operate as indicated. Include manual shutoff valves and connecting stem pipes to permit outlet servicing without shutdown of water supply piping systems.
- B. P-Traps: Include adjustable and removable P-traps where drains are indicated for direct connection to drainage system.
- C. Vacuum Breakers: Provide with flush valves where required by governing regulations, including locations where water outlets are equipped for hose attachment.

- D. Carriers: Provide carriers indicated, or if not indicated, provide cast-iron supports for fixtures of either graphite gray iron, ductile iron, or malleable iron as required.
- E. Fixture Bolt Caps: Provide manufacturer's standard exposed fixture bolt caps finished to match fixture finish.
- F. Escutcheons: Where fixture supplies and drains penetrate walls in exposed locations, provide chrome plated cast-brass escutcheons with set screw.
- G. All faucets, stops and fittings must be of one manufacturer with interchangeable parts, unless otherwise specified.

PART 3 - EXECUTION

3.1 INSPECTION AND PREPARATION:

- A. Examine roughing-in work of domestic water and waste piping systems to verify actual locations of piping connections prior to installing fixtures. Also examine floors and substrates, and conditions under which fixture work is to be accomplished. Correct any incorrect locations of piping, and other unsatisfactory conditions for installation of plumbing fixtures. Do not proceed with work until unsatisfactory conditions have been corrected.
- B. Install plumbing fixtures of types indicated where shown and at indicated heights; in accordance with fixture manufacturer's written instructions, roughing-in drawings, and with recognized industry practices. Ensure that plumbing fixtures comply with requirements and serve intended purposes. Comply with applicable requirements of the Kentucky State and local codes pertaining to installation of plumbing fixtures.
- C. Fasten plumbing fixtures securely to indicated supports or building structure; and ensure that fixtures are level and plumb. Secure plumbing supplies behind or within wall construction so as to be rigid, and not subject to pull or push movement.

3.2 CLEAN AND PROTECT:

- A. Clean plumbing fixtures of dirt and debris upon completion of installation.
- B. Protect installed fixtures from damage during the remainder of the construction period.
- 3.3 FIELD QUALITY CONTROL:
 - A. Upon completion of installation of plumbing fixtures and after units are water pressurized, test fixtures to demonstrate capability and compliance with requirements. When possible, correct malfunctioning units at site, then retest to demonstrate compliance; otherwise,

remove and replace with new units and proceed with retesting.

END OF 224000

230500 - COMMON WORK RESULTS FOR HVAC

PART 1 - GENERAL

1.1 GENERAL REQUIREMENTS:

A. All requirements under Division One and the General and Supplementary Conditions of these specifications shall be a part of this section. Each contractor shall be responsible to thoroughly familiarize himself with all its contents as to requirements which affect this division or section. The work required under this section includes all material, equipment, appliances, transportation, services, and labor required to complete the entire system as required by the drawings and specifications.

1.2 SCOPE

- A. The work included in this division consists of the furnishing of all labor, equipment, transportation, supplies, material, appurtenances and services necessary for the satisfactory installation of the complete and operating Mechanical System(s)/Equipment indicated or specified in the Contract Documents.
- B. Any materials, labor, equipment or services not mentioned specifically herein which may be necessary to complete or perfect any part of the Mechanical Systems in a substantial manner, in compliance with the requirements stated, implied or intended in the drawings and,or specifications, shall be included as part of this Contract.
- C. 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 the responsibility of the Contractors involved to coordinate all new systems with items of construction provided by others, and to relocate items which interfere with new equipment or materials required for the complete installation without additional cost to the Owner.

1.3 DEFINITIONS AND ABBREVIATIONS

- A. Contractor Any Contractor whether proposing or working independently or under the supervision of a General Contractor and,or Construction Manager and who installs any type of mechanical work (Controls, Plumbing, HVAC, Boiler Work, Sprinkler, Air Systems, etc.) or, the General Contractor.
- B. Engineer The Consulting Mechanical-Electrical Engineers either consulting to the Owners, Architect, other Engineers, etc.

- C. Architect The Architect of Record for the project.
- D. Furnish Deliver to the site in good condition and turn over to the Contractor who is to install.
- E. Provide Furnish and install complete, tested and ready for operation.
- F. Indicated Shown on the Drawings or Addenda thereto.
- G. Typical Where indicated repeat this work, method or means each time the same or similar condition occurs whether indicated or not.
- H. OSHA Office of Safety and Health Administration.
- I. NEC National Electrical Code.
- J. NFPA National Fire Protection Association.
- K. AGA American Gas Association
- L. ASME American Society of Mechanical Engineers.
- M. ANSI American National Standards Institute.
- N. ASHRAE American Society of Heating, Refrigeration and Air Conditioning Engineers.
- O. NEMA National Electrical Manufacturers Association.
- P. UL Underwriters Laboratories.
- 1.4 INSPECTION OF THE SITE:
 - A. The contractor shall personally inspect the site of the proposed work and inform himself fully as to the conditions under which the work is to be done. Failure to do so will not be considered sufficient justification to request or obtain extra compensation over and above the contract price.
- 1.5 MATERIAL AND WORKMANSHIP:
 - A. All material and apparatus shall be new and in first class condition. All workmanship shall be of the finest possible by experienced mechanics. All installations shall be made in a manner that will comply with applicable Codes and laws. Any abnormal noise caused by

rattling equipment, piping, ducts, air devices, and squeaks in rotating components will not be acceptable. In general, all materials and equipment shall be of commercial specification grade in quality.

1.6 DRAWINGS AND SPECIFICATIONS

- A. The drawings are diagrammatic only and indicate the general arrangement of the systems and are to be followed. If deviations from the layouts are necessitated by field conditions, detailed layouts of the proposed departures shall be submitted to the Engineer for approval before proceeding with the work. The drawings are not intended to show every item which may be necessary to complete the systems. All proposers shall anticipate that additional items may be required and submit their bid accordingly.
- B. Each 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.
- C. The Engineer shall reserve the right to make adjustments in location of piping, ductwork, equipment, etc. where such adjustments are in the interest of improving the project.
- D. Unless dimensioned, the mechanical drawings only indicate approximate locations of equipment, piping, ductwork, 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 to insure no conflict with other work.

1.7 COORDINATION:

- A. Coordinate all work with that of other trades so that the various components of the systems will be installed at the proper time, will fit the available space, and will allow proper service access to those items requiring maintenance. Any components which are installed without regard to the above shall be relocated at no additional cost to the owner.
- B. It is the Contractor's responsibility to provide materials with trim which will fit properly the types of ceiling, wall, or floor finishes actually installed. Model numbers in specifications or shown on drawings are not intended to designate the required trim.

1.8 ORDINANCES AND CODES:

A. Comply with National Fire Protection Association codes, Kentucky Building Code, International Mechanical Code, and/or all other applicable codes and ordinances. Obtain and pay for all permits. Contractor shall be held responsible for any violation of the law.

- B. The Contractor shall give all necessary notices, obtain and pay for all permits, government sales taxes, fees, inspections and other costs, in connection with his work. He shall also file all necessary plans, prepare all documents and obtain all necessary approvals of all governmental departments having any jurisdiction, whether indicated or specified or not.
- C. The contractor shall also obtain all required certificates of inspection for his work and deliver same to the Engineers before request for acceptance and final payment for the work. Contractor shall submit all required documents to obtain boiler permit and inspection.
- D. Contractor shall be responsible for submitting plans and obtaining boiler permit for boiler system and all hot water piping.

1.9 **PROTECTION OF EQUIPMENT:**

- A. Adequately protect equipment from damage after delivery to job. Cover with heavy polyethylene plastic as required to protect from plaster, dirt, paint, water, or physical damage. Equipment which has been damaged by construction activities will be rejected, and contractor is obligated to furnish new equipment of a like kind.
- B. Keep premises broom clean at all times from foreign material created under this contract. All piping, equipment, etc. shall have a neat and clean appearance at the termination of the work.

1.10 EQUIPMENT AND MATERIALS SUBSTITUTIONS OR DEVIATIONS

- A. When any Contractor requests approval of materials and/or equipment of different physical size, capacity, function, color, access, it shall be understood that such substitution, if approved, will be made without additional cost to anyone other than the Contractor requesting the change regardless of changes in connections, space requirements, electrical characteristics, etc. from that indicated, electrical service, etc.. In all cases where substitutions affect other trades, the Contractor requesting such substitutions shall advise all such Contractors of the change and shall renumerate them for all necessary changes in their work.
- B. NOTE: Any drawings, Specifications, Diagrams, etc., required to describe and coordinate such substitutions or deviations shall be professionally prepared at the responsible Contractor's expense. Review of Shop Drawings by the Engineers does not in any way absolve the Contractor of this responsibility.

C. Notwithstanding any reference in the specifications to any article, device, product, material, fixture, form, or type of construction by name, make or catalog number, such reference shall be interpreted as establishing a standard of quality and shall not be construed as limiting competition; any devices, products, materials, fixtures, forms, or types of construction which, in the judgment of the Engineer, are equivalent to those specified are acceptable, provided the provisions of the paragraph immediately preceding are met. Requested substitutions shall be submitted to the Engineer a minimum of five days prior to bids.

1.11 SUPERVISION OF WORK

A. Each Contractor shall personally supervise the work for which he is responsible or have a competent superintendent, approved by the Engineers, on the work at all times during progress with full authority to act for him.

1.12 SHOP DRAWINGS:

- A. Submit for approval eight sets of manufacturers shop drawings of all major items of equipment and all items requiring coordination between contractors. Before submitting shop drawings and material lists, the contractor shall verify that all equipment submitted is mutually compatible and suitable for the intended use, and shall fit the available space and allow ample room for maintenance. The Engineer's checking and subsequent approval of such shop drawings shall not relieve the contractor from responsibility for errors in dimensions, details, size of members, or quantities; or omissions of components or fittings; or for coordinating items with actual building conditions. Provide any needed wiring diagrams.
- B. Catalog data must have the item or model number clearly marked and all accessories indicated. Mark out all inapplicable items.

C. NOTE: Any shop drawings received without being reviewed and stamped by the Contractor shall be returned Rejected without review.

1.13 OPERATION AND MAINTENANCE INSTRUCTIONS:

- A. Submit to the architect four (4) copies each of material for maintenance and operation instruction manuals, appropriately bound into manual form including approved copies of the following, revised if necessary to show system and equipment as actually installed:
 - a) Manufacturers Catalog Sheets
 - b) Wiring Diagrams
 - c) Maintenance Instructions

- d) Recommended Maintenance Schedules and Timelines
- e) Operating Instructions
- f) Parts Lists
- g) Preventative Maintenance Recommendations
- B. All maintenance schedules and recommendations shall be developed in full coordination with the Engineer. All binders shall be as per the applicable Division I General Specifications, unless such specifications are not included or are not as stringent as the below requirements.

1.14 GUARANTEE:

- A. Each Contractor shall guarantee all equipment, apparatus, materials, and workmanship entering into this Contract to the best of its respective kind and shall replace all parts at his own expense, which are proven defective for a duration as indicated in the Division I General Conditions and Specifications.
- B. Where such duration is not identified, then guarantee shall be for one year from final acceptance of the work by the Engineer/Architect. The effective date of completion of the work shall be the date of the Engineer's (Architect's) Statement of Substantial Completion. Items of equipment which have longer guarantees, as called for in these specifications, 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 Engineer shall then submit these warranties, etc. to the Owner. Refer to other sections for any special or extra warranty requirements.

1.15 RECORD DRAWINGS

A. Each Contractor shall insure that any deviations from the Design are as they occur recorded in red, erasable pencil on record drawings kept at the jobsite. The Engineer may review the record documents from time to time to insure compliance with this specification. Compliance shall be a contingency of final payment. Pay particular attention to Deviations in the Control Systems. Keep information in a set of drawings set aside at the job site especially for this purpose and deliver to the Engineers the originals and three (3) copies of the record drawings upon completion of the work. Delivery of these documents will be contingent of final payment.

1.16 QUALIFICATIONS OF WORKMEN

A. All mechanical work shall be accomplished by qualified workmen competent in the area of work for which they are responsible. Mechanical contractors shall be licensed as required

by Kentucky State Law.

- B. All sheet metal, insulation and pipe fitting work shall be installed by workmen normally engaged or employed in these respective trades.
- C. All electrical work shall be installed only by competent workmen under direct supervision of a fully qualified Electrician.

1.17 CONDUCT OF WORKMEN

A. Each Contractor shall be responsible for the conduct of all workmen under his supervision. Misconduct on the part of any workman 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 of alcoholic beverages or other intoxicants, narcotics, barbiturates, hallucinogens or debilitating drugs on the job site is strictly forbidden.

1.18 ROUGH-IN:

A. Coordinate without delay all roughing-in with general construction. All piping, conduit, rough-in shall be concealed except in unfinished areas and where otherwise shown.

1.19 CUTTING AND PATCHING:

A. This contractor shall do all cutting of walls, floors, ceilings, etc. as required to install work under this section. Contractor shall obtain permission of the Architect before doing any cutting. All holes shall be cut as small as possible. Contractor shall patch walls, floors, etc. as required by work under this section. All patching shall be thoroughly first class and shall match the original material and construction.

1.20 ACCESSIBILITY

A. The Contractor shall locate and install all equipment so that it may be serviced, and maintained as recommended by the manufacturer. Allow ready access and removal of the entire unit and, or parts such as valves, filters, fan belts, motors, prime shafts, etc.

1.21 ELECTRICAL WIRING:

A. All power conduit and wiring shall be furnished by the electrical contractor. All control and interlock conduit and wiring for mechanical systems is the responsibility of the Mechanical Contractor; however he may choose to hire an electrician to perform this work. All wiring shall be in conduit and in accordance with the National Electric Code.
1.22 REQUIRED CERTIFICATIONS

- A. Upon completion of the project, the Contractor shall deliver all inspection certificates acquired during the course of the project to the Owner for their records.
- B. The Contractor shall upon completion of the Final Punch list, deliver to Architect and Engineer a written certification that all systems and work has been completed in compliance with the plans and specifications. The Contractor also shall deliver over to the Owner all required maintenance manuals and phone numbers of the equipment suppliers. The delivery of these documents and certifications will be required prior to final payment and release of retainage.

1.23 INDEMNIFICATION

A. The Contractor(s) shall hold harmless and indemnify the Engineer, employees, officers, agents 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.

PART 2 - PRODUCTS

NONE

PART 3 - EXECTUTION

NONE

230548 - VIBRATION AND SOUND CONTROLS FOR PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 DESCRIPTION OF WORK:

- A. Extent of vibration isolation work required by this section is indicated on drawings and schedules, and/or specified in other Division 15 sections.
- B. Types of vibration isolation products specified in this section include the following:
 - 1. Flexible Duct Connectors.
- C. Vibration isolation products furnished as part of factory-fabricated equipment, are specified as part of the equipment assembly in other Division 23 sections.
- 1.2 QUALITY ASSURANCE:
 - A. Product Qualification: Provide each type of vibration isolation unit produced by specialized manufacturer, with not less than 5 years' successful experience in production of units similar to those required for project.
- 1.3 QUALITY ASSURANCE:
 - A. Product Qualification: Provide each type of vibration isolation unit produced by specialized manufacturer, with not less than 5 years' successful experience in production of units similar to those required for project.

PART 2 - PRODUCTS

2.1 ISOLATION MATERIALS AND SUPPORT UNITS:

- A. Fiberglass Pads and Shapes: Glass fiber of not more than 0.18 mil diameter, produced by multiple-flame attenuation process, molded with manufacturer's standard fillers and binders through 10 compression cycles at 3 times rated load bearing capacity, to achieve natural frequency of not more than 12 Hertz, in thickness and shapes required for use in vibration isolation units.
- B. Neoprene Pads: Oil-resistant neoprene sheets, of manufacturer's standard hardness and cross-ribbed pattern, designed for neoprene-in-shear-type vibration isolation, and in thicknesses required.

- C. Flexible Duct Connectors: Laminated flexible sheet of cotton duct and sheet elastomer (butyl, neoprene or vinyl), reinforced with steel wire mesh where required for strength to withstand duct pressure indicated. Form connectors with full-faced flanges and accordion bellows to perform as flexible isolators unit, and of manufacturer's standard length for each size unless otherwise indicated. Equip each unit with galvanized steel retaining rings for airtight connection with ductwork.
- D. Available Manufacturers: Subject to compliance with requirements, manufacturers offering vibration isolation products, which may be incorporated in the work include, but are not limited to the following:

1.	Peabody Noise Control, Inc.
2.	Korfund Dynamics Corp.
3.	Mason Industries, Inc.
4.	Vibration Eliminator Co., Inc.

PART 3 - EXECUTION

3.1 APPLICATIONS:

- A. General: Except as otherwise indicated on drawings, apply the following types of vibration isolators at indicated locations or for indicated items of equipment. Selection is Installer's option where more than one type is indicated.
- B. Flexible Duct Connectors: Install at the following ductwork connections:
 - 1. Connections with vibration-isolation-mounted air handling equipment (i.e. Rooftop Unit Curb Plenum, Fan Powered Boxes, Vent Fans, etc.).
 - 2. Provide flexible duct connections wherever ductwork connects to vibration isolated equipment or as indicated on the Drawings. Construct flexible connections of neoprene coated flameproof fabric crimped into duct flanges for attachment to duct and equipment. Make airtight joint. Provide adequate joint flexibility to allow for thermal, axial, transverse, and torsional movement, and also capable of absorbing vibrations of connected equipment Duro-Dyne, Elgen, Ventfabric or equal. All canvas connections shall have a flame spread of 25 or less and smoke developed rating not higher than 50.
- C. Isolation Hangers: Install where the following suspended equipment is indicated:
 - 1. All in-line fans

230593 - TESTING, ADJUSTING AND BALANCING FOR HVAC

PART 1 - GENERAL

1.1 RELATED DOCUMENTS:

A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 1 Specification sections, apply to work of this section.

1.2 DESCRIPTION OF WORK:

- A. Extent of testing, adjusting, and balancing work is indicated by requirements of this section, and also by drawings and schedules, and is defined to include, but is not necessarily limited to, air distribution systems, hydronic distribution systems and associated equipment and apparatus of mechanical work. The work consists of pressure testing, setting speed and volume (flow) adjusting facilities provided for systems, recording data, conducting tests, preparing and submitting reports, and recommending modifications to work as required by contract documents.
- B. Component types of testing, adjusting, and balancing specified in this section includes the following as applied to mechanical equipment:
 - 1. Packaged Ground Mount Units
 - 2. Split System HVAC Units
 - 3. Exhaust/Ventilation Fans
 - 4. Air terminals

1.3 QUALITY ASSURANCE:

- A. Installer: A firm certified by Associated Air Balance Council (AABC) or National Environmental Balance (NEBB) in those testing and balancing disciplines similar to those required for this project.
- B. Industry Standards: Comply with American Society of Heating, Refrigerating and Air Conditioning Engineers, Inc. (ASHRAE) recommendations pertaining to measurements, instruments and testing, adjusting and balancing, except as otherwise indicated.

1.4 SUBMITTALS:

A. Submit certified test reports signed by Test and Balance Supervisor who performed TAB work.

B. Include identification and types of instruments used and their most recent calibration date with submission of final test report.

1.5 JOB CONDITIONS:

- A. Do not proceed with testing, adjusting, and balancing work until work has been completed and is operable. Ensure that there is no latent residual work still to be completed.
- B. Do not proceed until work scheduled for testing, adjusting, and balancing is clean and free from debris, dirt and discharged building materials.
- C. HVAC Testing, Adjusting and Balancing:
 - 1. All equipment shall be adjusted to operate as intended by the specification. All bearings shall be lined up. Bearings that have dirt or foreign material in them shall be replaced with new bearings without additional cost to the owner. All thermostats and control devices shall be adjusted to operate as intended. Adjust burners, fans, etc. for proper and efficient operation. Certify to Engineer that all adjustments have been made and that system is operating satisfactorily. Adjust all supply outlets to supply the amount of air shown on the drawings. Further adjustments shall be made to obtain uniform temperature in all spaces. Calibrate, set, and adjust all automatic temperature controls. Check proper sequencing of all interlock systems, and operation of all safety controls.
 - 2. Contractor shall employ the services of a testing and balancing firm to take test readings on all fans and units, and to adjust fan speeds to deliver specified amounts of air. Testing and balancing report logs shall be made showing all air supply quantities, fan and unit test readings, etc.; (3) three copies of the log shall be submitted to the Engineer before final inspection of the project and is necessary for final payment. Log shall be listed by unit, and shall additionally indicate unit horsepower, motor nameplate amps, and actual amps draw after all adjustments are completed. Also each room shall be listed with total exhaust, supply and return air quantities listed.
 - 3. Patch holes in insulation, ductwork and housings, which have been cut or drilled for test purposes, in manner recommended by original installer.
 - 4. Prepare a report of recommendation for correcting unsatisfactory mechanical performances when system cannot be successfully balanced; including, where necessary, modifications which exceed requirements of contract documents for mechanical work.

- 5. Retest, adjust and balance systems subsequent to significant system modifications, and resubmit test results.
- D. Additional Testing Requirements:

The certified test and balance company shall also perform the following tests in addition to the above test, and shall include the results of these tests with the test and balance report:

- 1. All ducted split system furnaces are to have the cooling capacities test and included in the report. The information shall include the following:
 - a. Entering air temperature and humidity
 - b. Leaving temperature and humidity
 - c. Airflow
 - d. Exterior outdoor ambient temperature and humidity
 - e. Exterior condensing unit nameplate voltage/phase/amps
 - f. Exterior condensing unit measured voltage/phase/amps

230700 - HVAC INSULATION

PART 1 - GENERAL

- 1.1 DESCRIPTION OF WORK:
 - A. Extent of mechanical insulation required by this section is indicated on drawings, and by requirements of this section.
 - B. Types of mechanical insulation specified in this section include the following:
 - 1. Ductwork Insulation:
 - a. Supply Air Duct Flexible duct to diffusers.
 - 2. Piping System Insulation:
 - a. Refrigerant Piping Systems
- 1.2 QUALITY ASSURANCE:
 - A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products which may be incorporated in the work include, but are not limited to the following:
 - 1. Babcock & Wilcox Co., Insulating Products Div.
 - 2. Certainteed Corp.
 - 3. Johns-Manville Corp.
 - 4. Keene Corp.
 - 5. Knauf Fiber Glass
 - 6. Owens-Corning Fiberglass Corp.
 - B. Flame/Smoke Ratings: Provide composite mechanical insulation (insulation, jackets, coverings, sealers, mastics and adhesives) with flame-spread rating of 25 or less, and smoke-developed rating of 50 or less, as tested by ANSI/ASTM E 84 (NFPA 255) method.
- 1.3 SUBMITTALS:
 - A. Product Data: Submit manufacturer's specifications and installation instructions for each type of mechanical insulation. Submit schedule showing manufacturer's product

number, thickness, and furnished accessories for each mechanical system requiring insulation.

B. Certified Tests: With product data submit certified test reports on performances including burning characteristics and thermal insulating valves.

1.4 DELIVERY, STORAGE AND HANDLING:

- A. Deliver insulation, coverings, cements, adhesives, and coatings to site in containers with manufacturer's stamp or label, affixed showing fire hazard ratings of products.
- B. Protect insulation against dirt, water, and chemical and mechanical damage. Do not install damaged insulation; remove damaged insulation from project site.

PART 2 - PRODUCTS

2.1 PIPING INSULATION:

A. Refrigerant piping shall be insulated with 1" thick Imcolock flexible polyolefin foam pipe insulation. Insulation shall bear U.L. listing for a 25/50 flame smoke spread, and shall be rated for duty in return air plenums. Product shall be stabilized against ultra-violet light degradation. As an option, exterior refrigerant piping and piping totally concealed in drywall may be an open cell foam insulation product similar to Armaflex, but <u>under no circumstances</u> shall Armaflex, or equal plastic type insulation, be used in a return air plenum. If Armaflex or similar product is used for outdoor service then two (2) coats of the weather-proofing sealant coating shall be applied as per manufacturer's installation instructions.

2.2 DUCT INSULATION FOR INTERIOR COOLING SUPPLY AIR AND EXTERIOR SUPPLY AIR DUCTWORK:

- A. Flexible Fiberglass Ductwork Insulation (Interior): FS HH-I-558, Form B, Type I. Insulation to have a density of 1.5 pcf density and shall have a "k" value of 0.28 maximum at 75 deg. F. Provide all-service insulation jacket with vapor barrier.
 - 1. Application: Provide thicknesses of insulation on ductwork as follows:
 - a. Cooling Supply Air Duct: 1.5" thick
- B. Insulation for Exposed Exterior Supply Air Duct work
 - 1. Exterior ductwork shall be insulated with Flexible Fiberglass Ductwork Insulation: FS HH-I-558, Form B, Type II, Grade 2, Type 100. Insulation to have a density of 1.0 pcf density minimum and shall have a "k" value of 0.27 maximum at 75 deg. F. Insulate supply and return air ductwork with 2" thick flexible insulation wrap. After insulating,

two coats of weather barrier mastic reinforced with fabric or mesh for outdoor application shall be applied to the entire surface. Each coat of weatherproof mastic & lagging shall be 1/16 inch minimum thickness, and shall overlap 2" minimum. An exterior sheet metal jacket shall then be applied; the exterior shall be a metal jacketing applied for mechanical abuse and weather protection, and secured with screws.

- 2. The exterior jacketing shall be smooth sheet aluminum or galvanized steel, 30 gauge. Corrugated jackets shall not be used outdoors. Provide joiner bands and overlapping joints as required to completely protect exterior insulation system. Paint the exterior of the jacketing with a primer and two (2) coats of a color to match the exterior masonry of the adjacent exterior wall; color shall be approved by Architect.
 - a. Thickness: 2" thick
- C. Ductwork Insulation Accessories: Provide staples, bands, wires, tape, anchors, corner and angles and similar accessories as recommended by insulation manufacturer for applications indicated. Provide cements, adhesives, coatings, sealers, protective finishes and similar compounds as recommended by insulation manufacturer for applications indicated.
- D. All insulating materials, adhesives, coatings, etc., shall have a flame spread of 25 or less and smoke developed rating not higher than 50. All containers for mastics and adhesives shall have U.L. Label.

PART 3 - EXECUTION

3.1 INSTALLATION OF PIPING INSULATION:

- A. General: Install insulation products in accordance with manufacturer's written instructions, and in accordance with recognized industry practices to ensure that insulation serves its intended purpose.
- B. Install insulation materials with smooth and even surface. Insulate each continuous run of piping or ductwork with full-length units of insulation, with single cut piece to complete run. Do not use cut pieces or scraps abutting each other.
- C. Clean and dry all surfaces prior to insulating. Butt insulation joints firmly together to ensure complete and tight fit over surfaces to be covered.
- D. Install protective metal shields and insulated inserts wherever needed to prevent compression of insulation. Pipe Hanger Insulation Inserts: Butt pipe insulation against pipe hanger insulation inserts.
- 3.2 INSTALLATION OF DUCTWORK INSULATION:

- A. General: Install insulation products in accordance with manufacturer's written instructions, and in accordance with recognized industry practices to ensure that insulation serves its intended purpose. All ductwork shall be externally insulated unless otherwise indicated.
- B. Install insulation materials with smooth and even surfaces.
- C. Clean and dry ductwork prior to insulating. Butt insulation joints firmly together to ensure complete and tight fit over surfaces to be covered.
- D. Maintain integrity of vapor-barrier on ductwork insulation, and protect it to prevent puncture and other damage.
- E. Extend ductwork insulation without interruption through walls, floors and similar ductwork penetrations, except at penetrations through exterior building barriers and where otherwise indicated.
- F. Refer to manufacturer's instructions for additional insulation installation requirements.

3.3 PROTECTION AND REPLACEMENT:

- A. Replace damaged insulation which cannot be repaired satisfactorily, including units with vapor barrier damage and moisture saturated units.
- B. Protection: Insulation Installer shall advise Contractor of required protection for insulation work during remainder of construction period, to avoid damage and deterioration.

230900 - AUTOMATIC TEMPERATURE CONTROL SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS:

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions Specifications section, apply to work of this section.
- 1.2 DESCRIPTION OF WORK:
 - A. Extent of electronic temperature control systems work is indicated by drawings and details, and by requirements of this section.

1.3 SUBMITTALS:

- A. Product Data: Submit manufacturer's specifications for each control device, including installation instructions and start-up instructions.
- B. Shop Drawings: Submit layout drawings of installed temperature control system including thermostats, controllers, switches, etc.. showing accurately scaled components and their relation to associated equipment, and connections. Submit shop drawings for each control system, containing the following information:
- C. Include verbal description of sequence of operation.

1.4 WARRANTY WORK:

- A. The Contractor shall be capable of responding to a warranty call within 24 hours of notification. The Contractor shall keep in stock material which routinely needs replacement or repairs.
- 1.5 DELIVERY, STORAGE AND HANDLING:
 - A. Provide factory shipping cartons for each piece of equipment and control device. Provide factory applied plastic end caps on each length of pipe and tube. Maintain cartons and end caps through shipping, storage and handling as required to prevent equipment and pipe end damage, and to eliminate dirt and moisture from equipment. Store equipment and materials inside and protected from weather.

PART 2 - PRODUCTS

2.1 GENERAL MATERIALS AND EQUIPMENT REQUIREMENTS:

A. General: Provide electric temperature control products in sizes and of capacities indicated, conforming to manufacturer's standard materials and components as published in their product information.

2.2 MATERIALS AND EQUIPMENT:

- A. General: Provide control products in sizes and capacities indicated, consisting of valves, dampers, thermostats, sensors, controllers, and other components and required for complete installation. Except as otherwise indicated, provide manufacturer's standard materials and components as published in their product information; designed and constructed as recommended by manufacturer, and as required for application indicated. Provide control systems with the following functional and construction features.
- B. Relays And Switches
 - 1. Relays and switches shall be of the positive and gradual acting type and shall be furnished and installed as required for the successful operation of the system. All switches shall have suitable indicating plates.
 - 2. The Contractor shall provide all required relays, low-voltage transformers, terminal strips, enclosures, wiring, etc. to ensure that the required control sequences are maintained. Fully coordinate with the equipment manufacturer all control requirements that involves relays to the motor starters.
- C. Carbon Dioxide Sensors/Controllers: Provide carbon dioxide sensors/controllers as indicated. Sensors shall achieve sensing through photoacoustic technology or other prior approved means. Sensor shall be complete with sampling chambers, transducers, wall mounting bracket & enclosure. provide with binary or analog output as needed. When binary "on-off" operation is desired, then provide DPDT control relay with unit. Manufacturer: The Trane Company or equal. Sensors shall include a display of present carbon dioxide measurement.

PART 3 - EXECUTION

3.1 INSPECTION:

A. Examine areas and conditions under which control systems are to be installed. Do not proceed with work until unsatisfactory conditions have been corrected in manner acceptable to Installer.

3.2 INSTALLATION OF AUTOMATIC TEMPERATURE CONTROLS:

A. General: Install systems and materials in accordance with manufacturer's instructions, roughing-in drawings and details shown on the Drawings.

3.3 INSPECTION:

- A. Examine areas and conditions under which control systems are to be installed. Do not proceed with work until unsatisfactory conditions have been corrected in manner acceptable to Installer.
- B. Control Wiring: Install control wiring, without splices between terminal points, colorcoded. Install in neat workmanlike manner, securely fastened. Install in accordance with National Electrical Code. Install wiring in electrical conduit.

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- C. Install circuits over 25-volt with colored coded wire. Wire gauge to be in accordance with National Electrical Code.
- D. Control wiring for analog functions shall be 18 AWG minimum with 600 volt insulation, twisted and shielded, 2 or 3 wire to match analog function hardware.
- E. Power Wiring: Obtain power for temperature controls.
 - 1. No more than 12 amps shall be put on one 20 amp circuit. No more than 3 circuits shall be run in one conduit.
- F. Sensor Wiring: Sensor wiring shall be 20 AWG minimum twisted and shielded, 2 or 3 wire to match analog function hardware.
- G. Software Programming: All software programs, including color graphic generation, shall be programmed by this Contractor.
- H. Supply Circuit Identification:
 - 1. Power feed locations for all controllers, DDC panels, etc. shall be indicated on the enclosures containing the device. Coordinate with electrical contractor and include Panel # and breaker.

3.4 FINAL ADJUSTMENT OF EQUIPMENT:

- A. After completion of installation, adjust control valves, motors and similar equipment provided as work of this section.
- B. Final adjustment shall be performed by specially trained personnel in direct employ of manufacturer of primary temperature control system. Coordinate services with Commissioning Authority.
- C. Instruct the Owner's representative in the operation and maintenance of all control systems and equipment.
- D. Final adjustment shall be performed by specially trained personnel in direct employ of manufacturer of primary temperature control system.
- E. Adjustment and Service:
 - 1. After completion of the installation, the automatic temperature control manufacturer shall regulate and adjust all thermostats, control valves, motors, and other equipment provided under his contract and shall place them in complete operating condition, subject to approval by the Architect and Owner.

3.5 PROGRAMMABLE THERMOSTATS FURNISHED BY MANUFACTURER

A. Programmable thermostats shall be wired with remote temperature sensors as indicated on the Drawings for all thermostatic control and operation to be located in the indicated office/storage area. Thermostats shall be programmed to the Owner's time schedules, and shall be thoroughly checked and placed in proper operation by the Contractor.

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Replace all units, where such thermostats are found faulty. Refer to equipment specifications and schedules for more information on scope of work.

3.6 EXHAUST FANS AND LOUVERS:

A. Contractor to provide relays, temperature sensors, carbon dioxide sensors, transformers, wiring and NEMA 1 enclosures as required to interlock exhaust fans and louver dampers to accomplish the control sequences indicated on the Drawings. Provide wiring diagrams to Engineer for review prior to purchase of any materials.

SECTION 232200 - REFRIGERATION PIPING SYSTEMS

PART 1 - GENERAL

1.1 DESCRIPTION OF WORK:

- A. Extent of refrigeration piping systems work is indicated on drawings and schedules, and by requirements of this section.
- B. Applications for refrigeration piping systems include the following:
 - 1. Refrigerant suction, liquid and hot gas bypass piping between air handlers and their respective condensing units.

1.2 QUALITY ASSURANCE:

- A. Installer: A firm with at least 3 years of successful installation experience on projects with refrigeration piping system work similar to that required for project.
- B. Brazing: Comply with applicable requirements of ANSI B31.5 and ANSI B31-5a, "Refrigeration Piping", pertaining to brazing of refrigeration piping for shop and project site locations.

1.3 SUBMITTALS:

- A. Product Data: Submit manufacturer's data for refrigeration piping systems materials and products.
- B. Brazing Certification: Certify brazing procedures, brazers and operators in accordance with ASME standards (ANSI B31.5).
- C. Shop Drawings: Submit scaled layout drawings of installed refrigeration pipe and fittings including, but not necessarily limited to, pipe sizes, locations, elevations and slopes of horizontal runs, wall and floor penetrations, and connections. Show interface and spatial relationship between piping and proximate equipment.

PART 2 - PRODUCTS

2.1 REFRIGERATION PIPING MATERIALS AND PRODUCTS:

A. General: Provide piping materials and factory fabricated piping products of sizes, types, pressure ratings, temperature ratings, and capacities as indicated. Where not indicated, provide proper selection as determined by Installer to comply with installation requirements. Provide materials and products complying with ANSI B31.5 Code for Refrigeration Piping where applicable, base pressure rating on refrigeration piping system maximum design pressures. Provide sizes and types matching piping and equipment connections; provide fittings of materials which match pipe materials used in refrigeration piping systems. Where more than 1 type of materials or products are indicated, selection is Installer's option.

2.2 BASIC PIPE, TUBE AND FITTINGS:

- A. General: Provide pipe, tube, and fittings in accordance with the following listing:
 - 1. Tube Size 4 1/8" and Smaller: Copper tube.
 - a. Wall Thickness: Type ACR, hard drawn temper.
 - b. Fittings: Wrought copper, solder joints. Joints: Soldered, silver lead solder, ANSI/ASTM B32, Grade 96 TS.
 - 2. Tube Size 3/4" and Smaller: Copper tube. Wall Thickness: Type ACR, soft annealed temper.
 - a. Fittings: Cast copper alloy for flared copper tubes.
 - b. Joints: Flared.
 - 3. Tube Size 7/8" through 4 1/8": Copper tube.
 - a. Wall Thickness: Type ACR, soft annealed temper.
 - b. Fittings: Wrought copper, solder joints.
 - c. Joints: Soldered, silver lead solder, ANSI/ASTM B32, Grade 96 TS.

2.3 SPECIAL REFRIGERATION VALVES:

- A. General: Special valves required for refrigeration piping systems include the following types:
- B. Ball and Check Valves:
 - 1. Shutoff Valves: Forged brass, packed, levered ball valves, 300°F (149°C) temperature rating, 500 PSI working pressure.
 - 2. Check Valves: Forged brass, accessible internal parts, soft synthetic seat, fully guided brass piston and stainless steel spring, 250°F (121°C) temperature rating, 500 PSI working pressure.
- C. Available Manufacturers: Subject to compliance with requirements, manufacturers offering ball and check valves which may be incorporated in the work include, but are not limited to the following:
 - 1. Henry Valve Co.
 - 2. Parker Hannifin Corp, Refrigeration & Air Conditioning Div.
 - 3. Sporlan Valve Co.

2.4 REFRIGERATION ACCESSORIES:

A. Thermal expansion valves and solenoid valves shall be as provided by the HVAC equipment supplier.

- B. Refrigerant Strainers: Brass shell end and connections, brazed joints, monel screen, 100 mesh, UL listed, 350 PSI working pressure.
- C. Moisture-Liquid Indicators: Forged brass, single port, removable cap, polished optical glass, solder connections, UL listed, 200°F (93°C) temperature rating, 500 PSI working pressure.
- D. Refrigerant Filter-Driers: Steel shell, ceramic fired desiccant core, solder connections, UL listed, 500 PSI working pressure.
- E. Available Manufacturers: Subject to compliance with requirements, manufacturers offering refrigeration accessories which may be incorporated in the work include, but are not limited to the following:
 - 1. Alco Controls Div., Emerson Electric Co.
 - 2. Henry Valve Co.
 - 3. Parker-Hannifin Corp., Refrigeration & Air Conditioning Div.
 - 4. Sporlan Valve Co.

PART 3 - EXECUTION

- 3.1 INSTALLATION OF REFRIGERATION PIPING:
 - A. Pitch refrigerant piping in direction of oil return to compressor. Provide oil traps and double suction risers where indicated, and where required to provide oil return.
- 3.2 INSTALLATION OF REFRIGERATION ACCESSORIES:
 - A. Refrigerant Strainers: Install in refrigerant lines as indicated or required, and in accessible location for service.
 - B. Moisture-Liquid Indicators: Install as indicated on refrigerant liquid lines or required, in accessible location.
 - C. Refrigerant Filter-Dryers: Install in refrigerant lines as indicated or required, and in accessible location for service.

3.3 EQUIPMENT CONNECTIONS:

A. General: Connect refrigerant piping to mechanical equipment in manner shown, and comply with equipment manufacturer's instructions where not otherwise indicated.

3.4 FIELD QUALITY CONTROL:

A. Refrigerant Piping Leak Test: Prior to initial operation, clean and test refrigerant piping in accordance with ANSI B31.5 and ANSI B31.5a, "Refrigeration Piping". Perform initial test with dry nitrogen, using soap solution to test all joints. Perform final test with 27" vacuum, and then 200 PSI using halide torch. System must be entirely leak free.

B. Repair or replace refrigerant piping as required to eliminate leaks, and retest as specified to demonstrate compliance.

END OF SECTION 232300

233113 - METAL DUCTS AND FANS

PART 1 - GENERAL

1.1 QUALITY ASSURANCE:

- A. SMACNA Compliance: Comply with applicable portions of Sheet Metal and Air Conditioning Contractor's National Association (SMACNA) HVAC duct construction standards, latest edition.
- B. Industry Standards: Comply with American Society of Heating, Refrigeration and Air Conditioning Engineers, Inc. (ASHRAE) recommendations pertaining to construction of duct accessories, except as otherwise indicated.
- C. UL Compliance: Construct, test, and label fire dampers in accordance with Underwriters Laboratories (UL) Standard 555 "Fire Dampers and Ceiling Dampers".
- D. NFPA Compliance: Comply with applicable provisions of ANSI/NFPA 90A "Air Conditioning and Ventilating Systems", pertaining to installation of duct accessories.

1.2 SUBMITTALS:

- A. Product Data: Submit manufacturer's data for each type of duct accessory, including dimensions, capacities, and materials of construction; and installation instructions.
- B. Submit assembly-type shop drawings for each type of duct assembly showing interfacing requirements with ductwork, and method of fastening or support.

PART 2 - PRODUCTS

2.1 <u>DUCTWORK MATERIALS</u>:

A. Sheet Metal: Except as otherwise indicated, fabricate ductwork from galvanized sheet steel complying with ANSI/ASTM A 527, lockforming quality, with ANSI/ASTM A 525, G90 zinc coating; mill phosphatized for exposed locations.

2.2 FILTERS:

- A. Two Types of filters shall be used where indicated on the drawings: 1" throwaway, and 2" pleated MERV 13 high efficiency throwaway.
- B. All air units shall have filters installed any time they are operated before final

acceptance. Provide extra set of filters and install in units just before turning over building to owner. Manufactured by Duststop, Farr, Cambridge, or approved equal.

2.3 DUCTWORK:

- A. Furnish and install all galvanized steel ductwork and housings as shown on drawings. All ducts shall be in conformance with current SMACNA Standards relative to gauge, bracing, joints, etc. Reinforce all housings and all ducts over 30" with 1¼" angles not less than 5'-6" on centers, and closer if required for sufficient rigidity to prevent vibration. Provide airtight joints and blade elbows. Support horizontal runs of duct on not to exceed 8'-0" centers from strap iron hangers.
- B. All offsets in ducts of 45 degrees or more shall have turning vanes of same gauge as duct and shall be rigidly fastened with guide strips. Vanes in ducts over 30" deep shall be installed in multiple sections with vanes not over 30" long and shall be rigidly fastened.
- C. Provide balancing dampers in all supply runouts, where shown on drawings and wherever necessary for complete control of air flow. Where access to dampers through a suspended ceiling is required, coordinate the proper location of the access doors. Provide "Spin-in" fitting and double bearing volume dampers for all round duct branch takeoffs to individual air devices. Spin-in fittings shall be installed with a minimum of (5-6) five to six sheet metal screws regardless of manufacturer's recommended screw layout.
- D. Duct Sealant: Non-hardening, non-migrating mastic or liquid elastic sealant (type applicable for fabrication/installation detail) as compounded and recommended by manufacturer specifically for sealing joints and seams in ductwork.
- E. Duct Cement: Non-hardening migrating mastic or liquid neoprene based cement (type applicable for fabrication/installation detail) as compounded and recommended by manufacturer specifically for cementing fitting components, or longitudinal seams in ductwork.
- F. Ductwork Support Materials: Except as otherwise indicated, provide hot dipped galvanized steel fasteners, anchors, rods, straps, trim and angles for support of ductwork.

2.4 FLEXIBLE DUCT:

A. Flexible duct shall be Class 1, insulation type, polymeric liner with steel wire helix core duct, fiberglass insulation 1¹/₂" thick and outer fiberglass vapor barrier jacket. Flexible

duct run shall not exceed 10 feet in length, and be installed in as straight a line as possible. Manufactured by Thermaflex "M-KE", Certainteed, Flexmaster.

2.5 DAMPERS:

A. Low Pressure Manual Dampers: Provide dampers of single blade or multiblade type, constructed in accordance with SMACNA "Low Pressure Duct Standards". Volume dampers shall be opposed blade interlocking type, factory made by Ruskin, APC, Air Balance, or approved equal.

2.6 TURNING VANES:

- A. Fabricated Turning Vanes: Provide fabricated turning vanes and vane runners, constructed in accordance with SMACNA "Low Pressure Duct Standards".
- B. Manufactured Turning Vanes: Provide turning vanes constructed of 1¹/₂" wide curved blades set at 1 1/2" o.c., and set into side strips suitable for mounting in ductwork, per SMACNA Standards for low pressure duct.

2.7 DUCT HARDWARE:

- A. Quadrant Locks: Provide for each damper, quadrant lock device on one end of shaft; and end bearing plate on other end for damper lengths over 12". Provide extended quadrant locks and end extended bearing plates for externally insulated ductwork.
- B. Concealed Damper regulators: For dampers located above inaccessible plaster or gypsum board ceilings, provide Young Regulator Co. Model No. 301 CDS concealed regulators with cover plates. Units shall be flush with finished surface. Key shall operate damper rod. Lock nut and spring washer shall hold damper in fixed position.
- C. <u>Bowden Cable Control Dampers</u>: Where indicated on the drawings, (or in lieu of the type 301 system) Bowden cable control dampers (by Young Regulator) are to be provided to control inaccessible manual dampers above inaccessible ceilings. Cable controllers shall be locking with rack and pinion holding damper securely at setting. The control system to consist of a concealed damper regulator, sheathed stainless steel cable system, rack and pinion controller, worm gear actuator and damper compatible with system. Concealed cup regulator to be Young 270-301(FS) with coverplate. System specialties must be submitted for review prior to purchase.

2.8 DUCT ACCESS DOORS:

A. Construction: Construct of same or greater gate as ductwork served, provide insulated

doors for insulated ductwork. Provide flush frames for uninsulated ductwork, extended frames for externally insulated duct. Provide one side hinged, other side with 1 handle type latch for doors 12" high and smaller, 2 handle type latches for larger doors.

2.9 EXHAUST FANS (EF):

- A. Provide tubular centrifugal fan, belt driven, vertical or horizontal mount, as scheduled. Jenn-air, Penn, Greenheck, Acme, Aerolator, Aerovent, Dayton, Cook or equal. Provide aluminum housings as scheduled, with the appropriate spark resistant construction. Provide capacitor-start, induction run type motor for belt driven fans.
- B. Provide fans with inlet and outlet flanges with mounting holes. All fans are to receive a corrosion resistant; refer to Drawings for type and application.
- C. Each fan to be provided with either spring mount vibration isolation or neoprene mounts; Refer to Drawings.
- D. Motors to be high efficiency.

PART 3 - EXECUTION

3.1 INSTALLATION:

- A. Install duct accessories in accordance with manufacturer's installation instructions, with applicable portions of details of construction as shown in SMACNA standards, and in accordance with recognized industry practices to ensure that products serve intended function.
- B. Support ducts rigidly with suitable ties, braces, hangers, and anchors of type which will hold ducts true to shape and to prevent buckling.
- C. Seal ductwork, to seal class recommended, and method prescribed in SMACNA "HVAC Duct Construction Standards" Latest Edition.
- D. Complete fabrication of work at project as necessary to match shop fabricated work and accommodate installation requirements.
- E. Locate ductwork runs, except as otherwise indicated, vertically and horizontally and avoid diagonal runs wherever possible. Locate runs as indicated by diagrams, details and notations, or if not otherwise indicated, run ductwork in shortest route which does not obstruct unusable space or block access for servicing building and its equipment. Hold

ducts close to walls, overhead construction, columns, and other structural and permanent enclosure elements of building. Limit clearances to ¹/₂" where furring is shown for enclosure of concealment of ducts, but allow for insulation thickness, if any. Where possible, locate insulated ductwork for 1" clearance outside of insulation. Wherever possible in finished and occupied spaces, conceal ductwork from view, by locating in mechanical shafts, hollow wall construction or above suspended ceilings. Coordinate layout with suspended ceiling and lighting layouts and similar finished work.

- F. Where ducts pass through interior partitions and exterior walls, conceal space between construction opening and duct over duct-plus-insulation with sheet metal flanges of same gage as duct. Overlap opening on 4 sides by at least 1¹/₂".
- G. Where ducts pass thru block walls, ensure that a lintel sized per the structural specifications is provide above penetration.
- H. Install turning vanes in all rectangular supply, return and outside air duct turns 45 deg. or greater.
- I. Coordinate duct installations with installation of accessories, dampers, equipment, controls and other associated work of ductwork system.
- J. Support ductwork in manner complying with SMACNA "HVAC Duct Construction Standards Latest Edition".

3.2 CLEANING AND PROTECTION:

A. Clean ductwork internally, unit-by-unit as it is installed, of dust and debris. Clean external surfaces of foreign substances which might cause corrosive deterioration of metal or, where ductwork is to be painted, might interfere with painting or cause paint deterioration.

3.3 TESTING FOR LEAKAGE:

A. General: After each duct system is completed, test for duct leakage in accordance with SMACNA "High Pressure Duct Standards - Latest Edition, Chapter 10 - Testing and Leakage". Repair leaks and repeat tests until total leakage is less than 3% maximum of system design air flow.

233713 - GRILLES, REGISTERS, DIFFUSERS, & LOUVERS

PART 1 - GENERAL

1.1 SUBMITTALS:

- A. Product Data: Submit manufacturer's data on outlets and inlets including the following:
- B. Schedule of outlets and inlets indicating drawing designation, room location, number furnished, model number, size and accessories furnished.
- C. Data sheet for each type of outlet and inlet, and accessory furnished; indicating construction, finish, and mounting details.
- D. Performance data for each type of outlet and inlet furnished, velocity traverse, throw and drop, and noise criteria ratings. Indicate selections on data.
- E. Ratings are to be certified by ADC or AMCA.
- 1.2 PRODUCT DELIVERY, STORAGE, AND HANDLING:
 - Deliver outlets and inlets wrapped in factory fabricated fiberboard type containers. Identify on outside of container type of outlet or inlet and location to be installed. Avoid crushing or bending and prevent dirt and debris from entering and settling in devices.
 - B. Store outlets and inlets in original cartons and protect from weather and construction work traffic. Where possible, store indoors; when necessary to store outdoors, store above grade and enclose with waterproof wrapping.

PART 2 - PRODUCTS

2.1 CEILING AIR DIFFUSERS:

- A. General: Except as otherwise indicated, provide manufacturer's standard ceiling air diffusers where shown; of size, capacity, direction of throw, and type indicated; constructed of materials and components as specified in this section and as required for complete installation.
- B. Types: Provide ceiling diffusers of type, capacity, and with accessories and finishes as indicated and as specified in this section. The following requirements shall apply:
- C. Diffuser Faces:

- 1. Square: Square housing, core of concentric louvers, square or round duct connection, housing extended to form panel to fit in ceiling module.
- 2. Rectangular: Rectangular housing, core of rectangular concentric louvers, square or rectangular duct connection.
- D. Ceiling Compatibility: Provide diffusers with border styles that are compatible with adjacent ceiling systems, and that are specifically manufactured to fit into ceiling module with accurate fit and adequate support. Refer to general construction drawings and specifications for types of ceiling systems which will contain each type of ceiling air diffuser.

E. Dampers:

- 1. Opposed Blade: Adjustable opposed blade damper assembly, key operated from face of diffuser.
- 2. Butterfly: 2 semi-circular flaps connected to linkage adjustable from face of diffuser with key, and with straightening grid.
- F. Diffuser Accessories:
 - 1. Operating Keys: Tools designed to fit through diffuser face and operate volume control device and/or pattern adjustment.
- G. Available Manufacturers: Subject to compliance with requirements, manufacturers offering diffusers which may be incorporated in the work include, but are not limited to the following:
 - 1. Airguide Corp.
 - 2. Anemostat Products Div., Dynamics Corp. of America
 - 3. Carnes Co., Div. of Wehr Corp.
 - 4. Barber-Colman Co., Air Distribution Div.
 - 5. Environmental Elements Corp., Subs. Koppers Co.
 - 6. Krueger Mfg. Co.
 - 7. Tuttle & Bailey Div. of Interpace Corp.
 - 8. Titus Co.

2.2 CEILING RETURN, EXHAUST AND TRANSFER AIR REGISTERS AND GRILLES:

A. General: Except as otherwise indicated, provide manufacturer's standard ceiling registers and grilles, where shown, of size, capacity and type indicated; constructed of materials and components as specified in this section; and as required for complete

installation.

- B. Ceiling Compatibility: Provide registers and grilles with border styles that are compatible with adjacent ceiling systems, and that are specifically manufactured to fit into ceiling module with accurate fit and adequate support. Refer to general construction drawings and specifications for types of ceiling systems which will contain each type of ceiling register or grille.
- C. Register and Grille Materials:
 - 1. Aluminum Construction: Manufacturer's standard extruded aluminum frames and adjustable blades, unless noted otherwise.
- D. Register and Grille Faces:
 - 1. Horizontal Straight Blades: Horizontal blades, individually adjustable, at manufacturer's standard spacing.
 - 2. Vertical Straight Blades: Vertical blades individually adjustable at manufacturer's standard spacing.
- E. Register Dampers:
 - 1. Opposed Blade: Adjustable opposed blade damper assembly, key operated from face of register.
- F. Register and Grille Accessories:
 - 1. Operating Keys: Tools designed to fit through register or grille face and operate volume control device and/or pattern adjustment.
- G. Available Manufacturers: Subject to compliance with requirements, manufacturers offering registers and grilles which may be incorporated in the work include, but are not limited to the following:
 - 1. Airguide Corp.
 - 2. Anemostat Products Div., Dynamics Corp. of America
 - 3. Barber Colman Co., Air Distribution Div.
 - 4. Carnes Co., Div. of Wehr Corp.
 - 5. Environmental Elements Corp., Subs, Koppers Co.
 - 6. Tempmaster Corp.
 - 7. Titus Co.

PART 3 - EXECUTION

3.1 INSPECTION:

- A. Examine areas and conditions under which outlets and inlets are to be installed. Do not proceed with work until unsatisfactory conditions have been corrected.
- 3.2 INSTALLATION:
 - A. General: Install all outlets and inlets as recommended by the manufacturer; in accordance with recognized industry practices; to insure that products serve intended functions.
 - B. Coordinate with other work, including ductwork and duct accessories, as necessary to interface installation of outlets and inlets with other work.
 - C. Provide transition ductwork as required to mate to the device inlet/outlet.

SECTION 237413 – PACKAGED OUTDOOR CENTRAL STATION AIR-HANDLING UNITS

PART 1 - GENERAL

1.1 QUALITY ASSURANCE:

- A. Manufacturers: Firms regularly engaged in manufacturer of terminal units, of types and sizes required, whose products have been in satisfactory use in similar service for not less than 5 years.
- B. ARI Compliance: Test and rate heat pump units in accordance with Air Conditioning and Refrigeration Institute (ARI) Standards.
- C. UL or ETL Compliance: Construct and install heat pump units in compliance with applicable standards.

1.2 SUBMITTALS:

- A. Shop Drawings: Submit assembly type shop drawings showing unit dimensions, construction details, and field connection details.
- B. Maintenance Data: Submit maintenance instructions, including lubrication instructions, filter replacement, motor, and drive replacement, and spare parts lists. Include this data in maintenance manuals.

PART 2 - PRODUCT

2.1 PACKAGED GROUND BASED GAS-FIRED HVAC UNITS:

- A. This contractor shall furnish and install package type gas heating and electric cooling package units, with all its components assembled into one compact weather proof casing, mounted on a common base and installed on a concrete base. All rotating equipment within the unit shall be mounted on vibration isolators.
- B. Controls shall be factory wired with required control transformers and contactors. Provide 24/7 programmable thermostat with remote occupant override for Occupied/Unoccupied scheduling, as indicated on the Drawings. Thermostat to be BACNet compliant and suitable for future interconnection with a BACnet network.
- C. Units provided as indicated, with economizers, shall have low-leakage dampers, and shall be capable of introducing up to 100% outside air. Economizers shall have factory controls with enthalpy control and temperature sensors. Economizer dampers shall close fully to use 100% return air when the unit goes to a night setback condition or if the unit shuts-off. Provide unit with the following additional capabilities:
 - 1. When unit is in Occupied mode, the outside air dampers are to move to intake a low ventilation CFM value indicated on the Drawings.
 - 2. When a wall mounted carbon dioxide sensor detects indoor air quality of carbon dioxide levels in excess of 875 PPM (adj), then dampers to move to intake a higher ventilation value (See Drawings).

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- 3. When unit system is in Unoccupied mode, then outside air dampers to close 100%.
- 4. Economizer operation will override outside and return damper controls.
- D. 100% Modulating Exhaust Fan: A field or factory supplied power exhaust fan to be provided to track exhaust with the economizer dampers.
- E. The heating section of each unit shall consist of heat exchangers constructed of aluminized steel, and shall be capable of operating quietly and cleanly on all stages. Each unit shall be provided with a combustion air blower equipped with an air pressure switch which proves blower operation before allowing automatic main gas valve to open. Heating units shall have direct spark ignition system, and 100% safety electric or electronic controls. Each unit shall be tested and approved in compliance with governing safety codes. Gas heating burner controls shall be modulating.
- F. Weatherproof cabinets shall be heavy gauge hot-dipped galvanized steel with baked enamel finish, and all interior panels shall be lined with 1" thick minimum fiberglass insulation with an approved coating on the air surface side. Filter section shall be complete with 2" MERV 8 throwaway filters or approved equal. Complete service access shall be provided to all interior equipment and controls.
- G. Each unit shall be provided with a complete factory-sealed refrigeration system consisting of dual circuited compressors, condenser coil and fans, evaporator coil and blower, refrigerant lines fully connected, and a full charge of refrigerant. Controls shall consist of necessary pressure switches, compressor non-recycling relay, smoke detector in return air, and overload protection.
- H. Additional requirements shall include the following:
 - 1. Stainless steel condensate pans
 - 2. Low leak exhaust dampers
- I. Unit shall be complete with manufacturer's one year guarantee on all components plus an additional four year guarantee on the compressors. Units shall be Daikin, Lennox, Trane, Carrier, Johnson Controls/York or AAON. See drawings for capacities, voltages, etc.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. General: Install HVAC units as indicated and in accordance with manufacturer's installation instructions. All venting and intake piping materials used shall meet with the listing requirements of the furnace. No venting materials to be used, which are not specifically approved by the furnace manufacturer.
- B. Uncrate units and inspect for damage. Verify that nameplate data corresponds with unit designation.
- C. Protect units with protective covers during balance of construction.

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D. Make duct connections with flexible duct connectors.

3.2 ADJUSTMENT AND CLEANING OF UNITS:

- A. General: After construction is completed, including painting, clean unit exposed surfaces, vacuum clean terminal coils and inside of cabinets.
- B. Retouch any marred or scratched surfaces of factory finished cabinets, using finish materials furnished by manufacturer.

END OF SECTION 237413

238127 - UNITARY HVAC EQUIPMENT

PART 1 - GENERAL

1.1 QUALITY ASSURANCE:

- A. Manufacturers: Firms regularly engaged in manufacturer of terminal units, of types and sizes required, whose products have been in satisfactory use in similar service for not less than 5 years.
- B. ARI Compliance: Test and rate heat pump units in accordance with Air Conditioning and Refrigeration Institute (ARI) Standards.
- C. UL or ETL Compliance: Construct and install heat pump units in compliance with applicable standards.

1.2 SUBMITTALS:

- A. Shop Drawings: Submit assembly type shop drawings showing unit dimensions, construction details, and field connection details.
- B. Maintenance Data: Submit maintenance instructions, including lubrication instructions, filter replacement, motor, and drive replacement, and spare parts lists. Include this data in maintenance manuals.

PART 2 - PRODUCTS

2.1 COOLING ONLY CONDENSING UNITS (CU):

- A. The exterior condensing units shall be Trane, York, Daikin, Mitsubishi, Carrier, Lennox, or approved equal. Provide split system cooling only service as listed on the drawings. Units shall be UL and ARI listed.
- B. Provide unit with compressor mounted on vibration isolators, suction accumulator, loss of charge protection, high pressure cut-out, low suction pressure protection, external service valves, test port, crankcase heater, liquid line solenoid valve, thermostatic expansion valve, and liquid line filter-drier.
- C. Provide unit with heavy ga. chassis and weather resistant coating, and full charge of R-410A refrigerant.
- D. Provide unit with accessories and additional requirements as listed on the drawings.

2.1 GAS FURNACES WITH DX COOLING COILS (GF)

- A. Provide horizontal or vertical flow propane gas fired furnaces Trane, Carrier, York, Lennox or equal as scheduled on the drawings. Unit construction shall be certified by A.G.A. Units shall be provided with aluminized steel primary heat exchanger.
- B. Unit casing shall be heavy gauge steel with baked enamel finish. The heat exchanger section shall be insulated, and the filters shall be 1" replaceable.
- C. Unit shall be provided with standard 100% safety controls to shut off all gas supply in case of malfunction. Ignition shall be electronically controlled by the unit control system with flame sensing devices. Provide all drain and vent components.
- D. All venting and intake piping materials used shall meet with the listing requirements of the furnace. No venting materials to be used, which are not specifically approved by the furnace manufacturer.
- A. Unit shall be provided with programmable 7-day/24-hour thermostatic controls, staged for heating and cooling. Provide all control transformers and relays as required. See control specifications for other potential requirements of thermostats.
- B. Provide vertical units with discharge refrigerant 'A' frame cooling coil. All coils to be manufactured of copper tubes and aluminum fins. Coil casings shall be insulated, and shall be provided with drain pan and condensate pipe connections, with condensate overflow safety switch. Capacity control by factory installed expansion valve.

2.2 AIR HANDLING UNITS (AHU)

- A. Provide ductless air handling units equal to Trane, Daikin, Mitsubishi, Carrier, York, Lennox or equal as scheduled on the drawings. Orientations shall be as indicated. Unit construction shall be listed by U.L. Provide washable filter and condensate lift pump integral within chassis.
- B. Unit casing shall be heavy gauge steel with baked enamel finish, or heavy durable plastic within integral colored finish.
- C. Unit shall be provided with standard factory controls. Provide "auto-on-off" automatic change-over thermostat. Provide all control transformers and relays as required.

PART 3 - EXECUTION

3.1 INSTALLATION

A. General: Install units as indicated and in accordance with manufacturer's installation instructions.

- B. Uncrate units and inspect for damage. Verify that nameplate data corresponds with unit designation.
- C. Protect units with protective covers during balance of construction.

3.2 ADJUSTMENT AND CLEANING OF UNITS:

- A. General: After construction is completed, including painting, clean unit exposed surfaces, vacuum clean terminal coils and inside of cabinets.
- B. Retouch any marred or scratched surfaces of factory finished cabinets, using finish materials furnished by manufacturer.

260500 - GENERAL PROVISIONS – ELECTRICAL

PART 1 - GENERAL

- 1.1 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.
- 1.2 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.
- 1.3 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.
- 1.4 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.
- 1.5 It is not the intent of this Section of the Specifications to make any Contractor, other than the General Contractor or Prime Contractor, 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.
- 1.6 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.
- 1.7 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.
- 1.8 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: Technical Horizons, 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.
- 0. 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. ADA Americans with Disabilities Act.
- T. ANSI American National Standards Institute.
- U. ASA American Standards Association.
- V. ASTM American Society for Testing Materials.
- W. ASHRAE American Society of Heating, Refrigeration and Air Conditioning Engineers.
- X. BAS Building Automation System.
- Y. BICSI Building Industry Consulting Services International

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- Z. CM Construction Manager
- AA. EE Electrical Contractor
- BB. FCC United States Federal Communications Commission
- CC. GC General Contractor
- DD. IECC International Energy Conservation Code
- EE. IEEE Institute of Electrical and Electronics Engineers.
- FF. ISO International Standards Organization.
- GG. KBC Kentucky Building Code.
- HH. NEC National Electrical Code (NFPA 70).
- II. NECA Standards for Installation.
- JJ. NEMA National Electrical Manufacturers Association.
- KK. NESC National Electrical Safety Code.
- LL. NFPA National Fire Protection Association.
- MM. OSHA Office of Safety and Health Administration.
- NN. TIA Telecommunications Industry Association
- 00. RFI Request for Information
- PP. ROI Rough-in Only
- QQ. UL Underwriters Laboratories, Inc.
- RR. UON Unless otherwise noted.
- 1.9 Note: 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 General Contractor or Construction Manager holding the prime contract, unless otherwise provided herein.
- 1.10 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.
- 1.11 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.

PART 2- INTENT AND INTERPRETATION

2.1 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."
- 2.2 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.
- 2.3 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.
- 2.4 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.
- 2.5 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.
- 2.6 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.
- 2.7 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.

PART 3- ELECTRICAL DRAWINGS AND SPECIFICATIONS

- 3.1 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.
- 3.2 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.

3.3 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.

- 3.4 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.
- 3.5 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.
- 3.6 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.
- 3.7 Should overlap of work between the various trades become evident, this shall be called to the attention of the Engineer. In such 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.
- 3.8 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.
- 3.9 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.
- 3.10 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.
- 3.11 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.

PART 4- EXAMINATION OF SITE AND CONDITIONS

- 4.1 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.
- 4.2 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 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.

4.3 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 15 and 16 and the General Contractor's procedures.

PART 5- EQUIPMENT AND MATERIALS SUBSTITUTIONS OR DEVIATIONS

- 5.1 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.
- 5.2 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.

- 5.3 Wherever any equipment and material is specified exclusively only such items shall be used unless substitution is accepted in writing by the engineers.
- 5.4 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.

PART 6- SINGLE SOURCE RESPONSIBILITY AND OBSOLETE EQUIPMENT

6.1 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.

PART 7- CODES, RULES, PERMITS, FEES, REGULATIONS, ETC.

- 7.1 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.
- 7.2 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.

- 7.3 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.
- 7.4 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.
- 7.5 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.
- 7.6 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 reviewing authority having jurisdiction. Electrical work shall not commence until such plans are in the hands of the Electrical Contractor.
- 7.7 The Contractor shall insure that his work is accomplished in accord with OSHA Standards and any other applicable government requirements.
- 7.8 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.

PART 8- COST SUPERVISION OF WORK

8.1 Each Contractor and Sub-Contractors shall always personally supervise the work or have a competent superintendent on the project site during progress of the work, with full authority to act for him in matters related to the project.

PART 9- BREAKDOWNS

9.1 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.

- 9.2 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:
 - A. Permitting
 - B. Mobilization
 - C. Electrical Shop Drawings/Submittals
 - D. Electrical Coordination Drawings
 - E. Temporary Power

- F. Interior Lighting Materials & Labor
- G. Exterior Lighting Materials & Labor
- H. Lighting Controls Materials & Labor
- I. Electrical Distribution (Switchgear) Materials & Labor
- J. Feeders Materials & Labor
- K. Branch Circuiting Materials & Labor
- L. Service Grounding Materials & Labor
- M. Surge Suppression Materials & Labor
- N. Electrical Devices Materials & Labor
- 0. Ladder/Cable Trays Materials & Labor
- P. Fiber/Communication Duct Banks Materials & Labor
- Q. Fire Alarm Materials & Labor
- R. Access Controls Equipment and Cabling Materials & Labor
- S. Security Equipment and Cabling Materials & Labor
- T. Fire Alarm System Startup, Testing, & Verification (shall equal 5% of Equipment Value)
- U. Electrical Distribution Equipment Startup, Testing, & Verification (shall equal 2.5% of Equipment Value)
- V. Lighting and Lighting Controls Startup, Testing, & Verification (shall equal 2.5% of Equipment Value)
- W. Low-Voltage Systems Startup, Testing, & Verification (shall equal 5% of Equipment Value)
- X. Owner Training & Acceptance
- Y. Punchlist
- Z. As-Built/Record Drawings & Acceptance
- AA. O&M Manuals & Acceptance
- BB. Warranty
- CC. Demobilization

PART 10- GUARANTEES AND WARRANTIES

- 10.1 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.
- 10.2 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 Owner shall be liable for any damage to equipment during this period due to negligence of his operator or other employee.

- 10.3 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.
- 10.4 All light fixtures shall have a five (5) year unconditional warranty. (Parts and Labor)
- 10.5 Provide all warranty certificates to Owner. All warranties begin starting at the substantial completion date, submit warranty certificates accordingly.
- PART 11 INSPECTION, APPROVALS AND TESTS
- 11.1 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, All internal punch list have been reviewed, completed and verified 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.
- 11.2 Owner's and Engineer's inspections: Two inspections will be held to generate and then review punch list items. All site visits thereafter shall be billed to the Contractor at the Engineer's standard hourly rates.
- 11.3 The Contractor shall provide as a part of this contract electrical inspection by a competent Electrical Inspection Agency, licensed to provide such services. The name of this agency shall be included in the list of materials of the Form of Proposal by the Contractor. All costs incidental to the provision of electrical inspections shall be borne by the Electrical Contractor.
- 11.4 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.

- 11.5 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.
- 11.6 Approval by an Inspector does not relieve the Contractor from the responsibilities of furnishing equipment having a quality of performance equivalent to the requirements set forth in these plans and specifications. All work under this contract is subject to the review of the Architect and/or Engineer, whose decision is binding.
- 11.7 Before final acceptance, the Contractor shall furnish three (3) copies of the certificates of final approval by the Electrical Inspector (as well as all other inspection certificates) to the Engineer with one (1) copy of each to the appropriate government agencies, as applicable. Final payment for the work shall be contingent upon completion of this requirement.
- 11.8 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.

PART 14 - SURVEYS, MEASUREMENTS AND GRADES

- 14.1 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.
- 14.2 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.
- 14.3 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.

PART 15- UTILITY COMPANY REQUIREMENTS

15.1 The Contractor shall provide the local utility company with a drawing produced by a licensed

Land Surveyor or a licensed Engineer and acceptable to the utility that locates the centerline of the primary duct. Coordinate further requirements with utility company.

- 15.2 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.
- 15.3 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.
- 15.4 Each contractor, prior to bidding the work, is to contact the utility companies (electric, data, telephone and cable TV) 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.

PART 16- TEMPORARY SERVICES

- 16.1 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.
- 16.2 All temporary services shall be removed by Contractor prior to acceptance of work.

PART 17- TEMPORARY USE OF EQUIPMENT

17.1 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.

17.2 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.

PART 18- MATERIALS AND WORKMANSHIP

18.1 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).

- 18.2 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.
- 18.3 All materials, where applicable, shall bear Underwriters' Laboratories label or that of another Engineer approved testing agency, where such a standard has been established.
- 18.4 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 makers mark or name.
- 18.5 All electrical equipment shall bear the manufacturer's name and address and shall indicate its electrical capacity and characteristics.
- 18.6 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.
- 18.7 Comply with National Electrical Contractors Association (NECA) performance standards that are published as National Electrical Installation Standards (NEIS).
- 18.8 All applicable equipment and devices provided shall meet all FCC requirements and restrictions.

PART 19- QUALIFICATIONS OF WORKMEN

- 19.1 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.
- 19.2 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.
- 19.3 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.
- 19.4 All electrical work shall be accomplished by Journeymen electricians and electrical apprentices 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.

19.5 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.

PART 20- CONDUCT OF WORKMEN

20.1 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.

PART 21 - COOPERATION AND COORDINATION BETWEEN TRADES

- 21.1 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 affected.
- 21.2 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.
- 21.3 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 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.
- 21.4 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.

PART 22 - PROTECTION OF EQUIPMENT

22.1 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.

PART 23 - SCAFFOLDING, RIGGING AND HOISTING

23.1 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.

PART 24- CONCRETE WORK

24.1 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.

- 24.2 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.
- 24.3 Special Note: All pads and concrete lighting standard bases shall be crowned slightly to avoid water ponding beneath equipment.
- 24.4 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.
- 24.5 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.

PART 25- SMOKE AND FIRE PROOFING

- 25.1 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.
- 25.2 Firestopping materials and installation shall be by a single source through-out the project, by all trades.
- 25.3 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.
- 25.4 3M fire protection products are listed below. Equivalent products may be submitted if they are UL listed.
- 25.5 All fire-stopping shall be applied by a Contractor who is certified by the manufacturer of the firestopping product for installation of the product.
- 25.6 Fire-stopping materials to include but not limited to the following:
 - A. 3M fire barrier FS-195 wrap/strip.
 - B. 3M fire barrier CP 25 caulk.
 - C. 3M fire barrier MP moldable putty.
 - D. 3M fire barrier RC-1 restricting collar with steel hose clamp.

- E. 3M fire barrier damming materials.
- F. 3M fire barrier CS-195 composite sheet.
- G. 3M fire barrier fire dam 150 caulk.
- H. Steel sleeves.
- I. Hilti Speed Sleeves.

PART 26- QUIET OPERATION, SUPPORTS, VIBRATION AND OSCILLATION

- 26.1 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.
- 26.2 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.
- 26.3 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.

PART 27- WELDING

27.1 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.

PART 28- ACCESSIBILITY

- 28.1 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.
- 28.2 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.
- 28.3 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.

PART 29- RESTORATION OF NEW OR EXISTING SHRUBS, PAVING, ETC.

29.1 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.

PART 30 - MAINTENANCE OF EXISTING UTILITIES AND LINES

- 30.1 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.
- 30.2 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.
- 30.3 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.
- 30.4 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.
- 30.5 The Contractor shall repair to the satisfaction of the Engineer any surface or subsurface improvements damaged during the work, unless such improvement is shown to be abandoned or removed.
- 30.6 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.
- 30.7 Protect all new or existing lines from damage by traffic, etc. during construction.
- 30.8 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.

PART 31 - MANUFACTURER'S NAMEPLATE

31.1 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.

PART 32 - ELECTRICAL CONNECTIONS

32.1 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 15 and 16 of Specifications, shop drawings and equipment schedules for additional information and requirements.

- 32.2 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 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.
- 32.3 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.

PART 33- FINAL CONNECTIONS TO EQUIPMENT

33.1 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.).

PART 34- ENERGIZED EQUIPMENT

34.1 At no time shall the contractor work on energized electrical equipment. Contractor shall always comply with NFPA 70E requirements throughout construction.

PART 35- MOTORS

35.1 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.

- 35.2 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 23 of the Specifications for further requirements and scheduled sizes.
- 35.3 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.

PART 36- CUTTING AND PATCHING

- 36.1 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.
- 36.2 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.

36.3 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.

PART 37- SLEEVES AND PLATES

- 37.1 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.
- 37.2 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.
- 37.3 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.
- 37.4 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:
 - A. Terminate sleeves flush with walls, partitions and ceiling.
 - B. In areas where pipes are concealed, as in chases, terminate sleeves flush with floor.
 - C. 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.
- 37.5 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.
- 37.6 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.

PART 38- ANCHORS

38.1 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.

PART 39- CONDUIT MOUNTING HEIGHTS

39.1 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.

PART 40- PAINTING

40.1 Each fixture device, panel, junction box, etc., that is 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.

PART 41 - WEATHERPROOFING

- 41.1 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 watertight.
- 41.2 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.

PART 42- EQUIPMENT/CONTROLS STARTUP & VERIFICATION

- 42.1 A pre-start-up conference shall be held with the Engineer, Owner, 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 discuss the goals, procedures, etc. for start-up
- 42.2 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.
- 42.3 The Contractor shall include in the bid to provide equipment and controls startup and verification for ALL Electrical and speciality Lighting 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 startup 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.
- 42.4 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.
- 42.5 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.

PART 43- OPERATING INSTRUCTIONS

43.1 Upon completion of all work and all tests, each Contractor shall furnish the necessary skilled labor and helpers for operating his systems and equipment for a period of three days of eight hours each, or as otherwise specified. During this period, instruct the Owner or his representative fully in the operations,

adjustment, and maintenance of all equipment furnished. Give at least one week's written notice to the Owner, Architect and Engineer in advance of this period. The Engineer may attend any such training sessions or operational demonstrations. 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.

- 43.2 Unless specified otherwise, 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.
- 43.3 Unless specified otherwise, 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.

PART 44- CLEANING

- 44.1 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 construction manager may cause cleaning to be done by others and charge the cost of same to the responsible Contractor. Each Contractor shall be responsible or all damage from fire which originates in, or is propagated by, accumulations of his rubbish or debris.
- 44.2 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 attention to finished area surfaces such as lighting fixture lenses, lamps, reflectors, panels, etc.

PART 45- INDEMNIFICATION

45.1 The Contractor shall hold harmless and indemnify the Engineer, employees, officers, agents 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.

PART 47- ABOVE-CEILING AND FINAL PUNCH LISTS

- 47.1 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.
 - A. For review of in-wall work that will be concealed by drywall or other materials well before substantial completion.
 - B. For review of the above-ceiling work that will be concealed by tile or other materials well before substantial completion.
 - C. For review of all other work as the project nears substantial completion.
- 47.2 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.

- 47.3 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.
- 47.4 At the engineer's option, the contractor shall supply digital photographs via email or file-share of any installed work.
- 47.5 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 net 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.
- 47.6 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.

PART 48- POSTED OPERATING INSTRUCTIONS

- 48.1 Provide for each system and principal item of equipment as specified in the technical sections for use by operation and maintenance personnel. The operating instructions shall include the following:
 - A. Wiring diagrams, control diagrams, and control sequence for each principal system and item of equipment.
 - B. Start up, proper adjustment, operating, lubrication, and shutdown procedures.
 - C. Safety precautions.
 - D. The procedure in the event of equipment failure.
 - E. Other items of instruction as recommended by the manufacturer of each system or item of equipment.
- 48.2 Print or engrave operating instructions and frame under glass or in approved laminated plastic. Post instructions where directed. For operating instructions exposed to the weather, provide weather-resistant materials or weatherproof enclosures. Operating instructions shall not fade when exposed to sunlight and shall be secured to prevent easy removal or peeling.

PART 49- TRAINING AND RELATED SUBMITTALS

- 49.1 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. Everyone 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.
- 49.2 The training phase shall be accompanied by complete as-built documentation and the technical systems operation manual.
- 49.3 These training sessions shall be videotaped by the Installer and copies provided to the Owner

within one (1) week of training

- 49.4 Brochures: Furnish Owner a complete set of operating instructions and diagrams.
- 49.5 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:
 - A. Lighting control system
 - B. Electrical Distribution (Switchgear)
 - C. Service Grounding
 - D. Electrical Devices
 - E. Fire Alarm Materials & Labor
 - F. Access Controls
 - G. lightning protection system including surge protection devices
 - H. Security
 - I. Video Surveillance
 - J. Critical power engine generator set and associated transfer switches.
- 49.6 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.
- 49.7 At completion of training, submit two complete training manual(s) for Owner's use.
- 49.8 Qualification Data: For facilitator, instructor and photographer.
- 49.9 Attendance Record: For each training module, submit list of participants and length of instruction time.
- 49.10 Demonstration and Training DVDs: Submit two copies within seven days of end of each training module.
- 49.12 Identification: On each copy, provide an applied label with the following information:
 - A. Name of Project.
 - B. Name and address of photographer.
 - C. Name of Architect and Construction Manager.
 - D. Name of Contractor.
 - E. Date video was recorded.
 - F. Description of vantage point, indicating location, direction (by compass point), and elevation or story of construction.
- 49.13 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.

PART 50- EQUIPMENT/SYSTEMS TESTING, VERIFICATION, & START-UP

- 50.1 The Contractor (and Sub-Contractors) shall be responsible for commissioning, starting-up, testing, checking, examining, inspecting, etc. their own systems.
- 50.2 The Electrical Contractor shall designate an individual under his employment to lead the startup, 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.

- 50.3 This individual shall also be responsible for the following items:
 - A. All identification and labeling requirements per plans and specifications.
 - B. Submission of switchgear coordination study, fault current study, and arc flash hazard analysis.
- 50.4 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.
- 50.5 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.
- 50.6 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.
- 50.7 Systems Requiring Testing & Verification:
 - A. Fire Alarm System
 - B. Electrical Distribution Equipment
 - C. Lighting and Lighting Controls
 - D. All Low-Voltage Systems
 - E. Grounding Systems
 - F. Wiring and Terminations
- 50.8 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.
- 50.9 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.
- 50.10 The completed reports shall be organized and bound together in a tabbed binder and submitted for review and approval.
- PART 51 SPECIAL WRENCHES, TOOLS AND KEYS
- 51.1 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.

PART 52- CLOSEOUT DOCUMENTS

- 52.1 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.
- 52.2 As-Built Record Drawings:
 - A. 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 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.
 - B. All underground utilities/piping installed as part of this project shall be surveyed by a land surveyor licensed in the State of Kentucky. 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.
 - C. Refer to additional record drawing requirements within the general conditions and other sections of these specifications.
- 52.3 Start-up and System Testing Certifications and Reports:
 - A. 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.
- 52.4 Operation and Maintenance Manuals
 - A. 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:
 - B. 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.
 - C. 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.

- D. The operation and maintenance document directory should provide easy access and be well organized and clearly identified.
- E. The operation and maintenance manuals shall contain the following information:
 - 1. Emergency information should be immediately available during emergencies and should include emergency and staff and/or agency notification procedures.
 - 2. Provide contacts (company name, address, phone number, email) where parts may be purchased for all equipment.
 - 3. Provide detailed maintenance instructions, including recommended preventative maintenance schedules for all equipment requiring maintenance. For lighting and lighting controls provide a schedule for inspecting and recalibrating lighting controls, and provide a recommended settings list for all components with adjustable settings.
 - 4. Technical Information. Provide the following:
 - a. System description
 - b. Operating routines and procedures
 - c. Seasonal start-up and shutdown
 - d. Special procedures

a.

- e. Basic troubleshooting
- 5. The maintenance manual should contain the following information:
 - Equipment data sheets. Provide the following:
 - 1) Operating and nameplate data
 - 2) Warranty
 - 3) Detailed operating instructions.
 - b. Maintenance program information. Provide the following:
 - 1) Manufacturer's installation, operation, and maintenance instructions
 - 2) Spare parts information
 - 3) Preventive maintenance actions
 - 4) Schedule of actions
 - 5) Action description
 - 6) History
- 6. Test reports document observed performance during start-up and commissioning.
- 52.5 Shop drawings will not be accepted as satisfying the requirement for Operation and Maintenance Manuals.
- 52.6 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.
- 52.7 Parts Lists: Provide an inventory of all spare parts, special tools, attic stock, etc. that have been provided to the owner.
- 52.8 Warranties: Contractor's one year warranty and all other specific warranties indicated in the Construction documents.
- 52.9 Training Verification: Provide certification that all specified training has been completed. List training session dates, times, and types.
- 52.10 Inspection Certificates: Provide certificates of inspection from electrical inspector, fire marshal,

and any other required special inspections.

- 52.11 Panel Schedules: Provide hard copies and digital copies of Excel files for all panel-board schedules.
- 52.12 Final Power System Study Reports.
- 52.13 Fire Alarm System Certification.
- 52.14 Lightning Protection System Certification.
- 52.15 Power Riser Diagram: Provide a framed full-size copy of the overall power riser diagram (under glass) to the Owner. Also provide three 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.
- 52.16 Fire Alarm Riser Diagram: Provide vinyl coated fire alarm system diagrams including floor plans and device addresses at fire alarm equipment. Provide a full system diagram at the main fire alarm control panel and provide the respective level's system diagram at the NAC panels located on other levels of the structure.

END OF 260500

260519 — LOW-VOLTAGE ELECTRICAL POWER, CONDUCTORS & CABLES

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 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.

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 is permitted for any conduit system, including video, intercom, data, 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 de-rated per NEC.
- G. Intentional or unintentional painting of exposed low voltage 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. Conductors #10 AWG and smaller sizes of wire shall be solid. Conductors #8 AWG and larger sizes shall be stranded.
- G. 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.
- H. All wire on the project shall be new, in good condition, and shall be delivered in standard coils or reels.
- I. 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.
- J. Conductors used for motor connections and connections to vibrating or oscillating equipment shall be extra flexible.
- K. All equipment grounding conductors shall have green color insulation or if larger than #8 AWG, shall be taped for two inches, green color at every termination and pull box access point.
- 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. Branch wiring and feeder conductors that are greater than 50' in length shall be increased at least one size to compensate for voltage drop. All 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.
- 0. No aluminum conductors shall be used under 100A.
- P. Multiconductor cable: Metal clad cable, Type MC with ground wire.
 - 1. Type "MC" cable shall be hospital grade and only use in exposed or accessible ceiling spaces and down walls for 15 to 30A circuits only. Type "MC" cable shall not be utilized above inaccessible hard ceilings or in damp locations. Cable shall be supported and secured where such support does not exceed 3 ft. intervals and shall be properly color coded to identify phase, neutral, ground and switch legs.

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.

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- 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.

PART 3- EXECUTION

- 3.1 CONDUCTOR AND INSULATION MATERIAL APPLICATIONS
 - B. Branch Circuits: Copper. Solid for #12 AWG and smaller; stranded for #8 AWG and larger.
 - C. Conductors used for motor connections and connections to vibrating or oscillating equipment shall be extra flexible stranded.
 - D. Conductors used for theatrical lighting branch cables shall be extra flexible stranded.
 - E. Lighting and receptacle branch circuits shall be Type THW, THHN or THWN insulation.
 - F. All feeders shall be Type THW or THWN of the size as shown on the Contract Drawings.
 - G. THHN wiring shall only be installed in overhead, dry or damp locations.
 - H. THWN or THW wiring shall be used for all circuits pulled in underground or other wet locations.
 - I. Class 1 Control Circuits: Type THHN-THWN, in raceway.
 - J. Cord Drops and Portable Appliance Connections: Type SO, hard service cord with stainlesssteel,

wire-mesh, strain relief device at terminations to suit application.

3.2 INSTALLATION

- A. 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.
- B. Use pulling means, including fish tape, cable, rope, and basket-weave wire/cable grips, that will not damage cables or raceway.
- C. 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.
- D. 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.
- E. 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.
- F. 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 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.
- G. 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.
- H. 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 caution when installing twisted pair data cable or fiber optic cables -- forces permitted for pulling in are typically very low for these cable types.
- I. 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.
- J. 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 conductor at each outlet, with at least 12 inches of slack.

3.4 FIELD QUALITY CONTROL

- A. Testing Agency: Engage a qualified testing agency to perform tests and inspections and prepare test reports.
- B. Perform tests and inspections and prepare test reports.
- C. Tests and Inspections:
 - 1. Perform each visual and mechanical inspection and electrical test stated in NETA Acceptance Testing Specification. Certify compliance with test parameters.
 - 2. Perform insulation resistance (megger) testing for all bus duct and feeders in accordance with NETA ATS. Testing may be witnessed by the Engineer and/or Commissioning agent. Schedule all tests with Architect with ample notice.
 - Megger tests shall be performed at a DC voltage of 1,000 volts for 600 volts rated equipment, and at a DC voltage of 500 volts for 120-300 volt rated equipment. Minimum acceptable (temperature corrected) resistance is 25 megaohms for 120-300 volt rated equipment and 100 megaohms for 600 volt rated equipment and wiring.
 - 4. Test instruments shall be calibrated to national standards within the last 12 months.
- D. Infrared Scanning: After Substantial Completion, but not more than 60 days after Final Acceptance, perform an infrared scan of each splice in cables and conductors #3 AWG and larger. Remove box and equipment covers so splices are accessible to portable scanner.
 - 1. Follow-up Infrared Scanning: Perform an additional follow-up infrared scan of each splice 11 months after date of Substantial Completion.
 - 2. Instrument: Use an infrared scanning device designed to measure temperature or to detect significant deviations from normal values. Provide calibration record for device.
 - 3. Record of Infrared Scanning: Prepare a certified report that identifies splices checked and that describes scanning results. Include notation of deficiencies detected, remedial action taken, and observations after remedial action.
- E. Test and Inspection Reports: Prepare a written report to record the following:
 - 1. Test procedures used.
 - 2. Results that comply with requirements.
 - 3. Results that do not comply with requirements and corrective action taken to achieve compliance with requirements.
- F. Cables will be considered defective if they do not pass tests and inspections. Remove and replace malfunctioning units and retest as specified above.
- G. Submit test results to Architect and Engineer for approval

3.5 IDENTIFICATION

- A. Color coding distribution voltage conductors, 600 volt or less
- B. Conductor jackets, in all sizes of cable, shall be provide in black, white, red, blue, green, yellow,

brown, orange and gray from the manufacturer. Tapped 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
- 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 260519

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.

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. Ground bonding common with lightning protection system.
- 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.
- 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.

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- 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.
- 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 16000 "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."

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 16120, LOW-VOLTAGE ELECTRICAL POWER, CONDUCTORS, CABLES, SPLICING DEVICES AND CONNECTORS.
- B. Ground Bus-Bar:
 - 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.
 - 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.
- 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 EINTIA 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 thermically welded type as manufactured by Cadweld, Burndy Co., Therm-O-Weld, or approved equivalent.

2.5 GROUNDING ELECTRODES

- A. Ground Rods: 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.
- B. Chemical-Enhanced Grounding Electrodes: Copper tube, straight or L-shaped, charged with non-hazardous electrolytic chemical salts.
 - 1. Termination: Factory-attached #4/0 AWG bare conductor at least 48 inches long.
 - 2. Backfill Material: Electrode manufacturer's recommended material.

2.6 CHEMICAL GROUNDING ELECTRODE SYSTEM:

A. The ground electrode system shall be as specified herein. The system shall not require maintenance throughout the expected life span of the materials.

- B. Ground system shall be an electrolytic rod type, as manufactured by Lyncole XIT Grounding, Superior Grounding Systems, LEC, Inc. (Chem-Rod), or approved equivalent. Electrode(s) shall be placed as shown on the plans, installed exactly per manufacturer's recommendations. Electrodes shall be installed vertically, 12 feet of overall length (or length as indicated), set in a drilled hole and backfilled per manufacturer's instructions with a special clay slurry surrounding the rod. Provide a concrete protection box with cast iron grate for the top of the rod termination. Ground system shall be per the following:
 - 1. Manufacturer: Lyncole XIT Grounding (or approved equivalent).
 - Source: Lyncole XIT Grounding, 22412 S. Normandie Ave., Torrance, CA 90502 1-800-962-2610
 - 3. Shaft Configuration: Straight.
 - 4. Shaft Length: 12 feet (or as otherwise indicated).
 - 5. Listings: U.L.-467J, ANSI 633.8.
 - 6. Material: Type K Copper.
 - 7. Construction: Hollow tube, 2.125" 0.D., chemical filled with non-hazardous metallic salts.
 - 8. Weight 3.5 lbs. per foot of length, nominal.
 - 9. Ground Wire Termination: Exothermic ("Cadweld" by Contractor) connection to 4/0 conductor, with U-bolt with pressure plate provided as test point.
 - 10. Average Life Expectancy: 25 Years.
 - 11. Model Number: K2-(length)CS.
 - 12. Provide grounding system with the following components: protective box, backfill material. Box to be concrete with cast iron, tamper-resistant lid, backfill to be "Bentonite" clay.
- C. Installation of Pipe Ground System:
 - 1. Pipe ground systems shall be installed exactly as required by the system manufacturer. The Contractor shall be diligent to observe the excavation, sealing tape removal, slurry backfill and all other critical requirements.
 - 2. Note: NEVER USE SAND OR ORDINARY EARTH AS A BACKFILL MATERIAL
 - 3. Pipe grounding system shall be warranted unconditionally by the Contractor for a period of one year from the date of substantial completion.

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 ductbank installation.
- C. Isolated Grounding Conductors: Green-colored insulation with continuous yellow stripe. On feeders with isolated ground, identify grounding conductor where visible to normal inspection, with alternating bands of green and yellow tape, with at least three bands of green and two bands of yellow.
- 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 GROUNDING SEPARATELY DERIVED SYSTEMS
 - A. Where NEC requires grounding for a separately derived system, ground according to NEC.
 - B. Generator: Install grounding electrode(s) at the generator location. The electrode shall be connected to the equipment grounding conductor and to the frame of the generator.

3.5 GROUNDING UNDERGROUND DISTRIBUTION SYSTEM COMPONENTS

- A. Comply with IEEE C2 grounding requirements.
- B. Grounding Manholes and Handholes: Install a driven ground rod through manhole or handhole floor, close to wall, and set rod depth so 4 inches will extend above finished floor. If necessary, install ground rod before manhole is placed and provide #1/0 AWG bare, tinned-copper conductor from ground rod into manhole through a waterproof sleeve in manhole wall. Protect ground rods passing through concrete floor with a double wrapping of pressure-sensitive insulating tape or heat-shrunk insulating sleeve from 2 inches above to 6 inches below concrete. Seal floor opening with waterproof, nonshrink grout.
- C. Grounding Connections to Manhole Components: Bond exposed-metal parts such as inserts, cable racks, pulling irons, ladders, and cable shields within each manhole or handhole, to ground rod or grounding conductor. Make connections with #4 AWG minimum, stranded, harddrawn copper bonding conductor. Train conductors level or plumb around corners and fasten to

manhole walls. Connect to cable armor and cable shields according to written instructions by manufacturer of splicing and termination kits.

3.6 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. Water Heater, Heat-Tracing, and Antifrost Heating Cables: Install a separate insulated equipment grounding conductor to each electric water heater and heat-tracing cable. Bond conductor to heater units, piping, connected equipment, and components.
- E. 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.
- F. 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.
- G. 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 JSTD-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.
- H. Metal Poles Supporting Outdoor Lighting Fixtures: Install a copper-clad steel, 3/4 inch in diameter by 10 feet long, ground rod and a separate insulated equipment grounding conductor at each pole in addition to grounding conductor installed with branch-circuit conductors.

3.7 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 not exceeding #6 AWG in size shall be green. Those larger than #6 AWG shall be green (same color everywhere) taped 4" at each termination, pull and junction boxes.
- 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 separate grounding conductor, except as otherwise noted.
- 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 generators, 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 thermically 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.
- L. Grounding connections shall never be made to fire protection, natural gas, flammable gas or liquid fuel piping, except where specifically indicated on the plans.
- M. 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

- 0. At all metallic outlet, junction and pull boxes, bond the equipment grounding conductor to the box.
- P. 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.
- Q. Test Wells: Ground rod driven through drilled hole in bottom of handhole. Handholes shall be at least 12 inches 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.

- R. 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.
- S. 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.
- T. 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.
- U. 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.
- V. 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.
- W. 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.

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 Pane!boards Serving Electronic Equipment: 1 ohm.
 - 5. Substations and Pad-Mounted Equipment shall be 5 ohms or less.
 - 6. Manhole Grounds shall be 10 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 selfcontained 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 Cl). 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 Cl and connect to measurement instrument.
- F. Drive the movable grounding probe (C3) into earth at ten equally spaced intervals, in a straight line between Cl 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.

END OF 260526

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.

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 16 Section 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. 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" 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. All empty conduit installed anywhere shall have pull-strings installed for future cabling installation. Coordinate with vendors and provide extra pull-strings as required to ensure that when cabling is pulled, conduit still pull-strings installed for future use.
- K. Fire Alarm Cabling (conduit): All fire alarm conductors shall be installed within conduit and enclosed junction boxes. Provide a completely separate raceway 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.

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.

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.
- 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.

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.
- 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 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.

I. RIGID NON-METALLIC CONDUIT

a.

- 1. Polyvinylchloride (PVC) Conduit:
 - PVC conduit shall be Type II, in conformance with NEMA TC2 and the following:1) Schedule 40, 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.

J. RACEWAY FITTINGS

- 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 nonshrink 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 be constructed of aluminum extrusions and 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, predivided raceway bases, dual covers, appropriate fittings and device mounting plates necessary for a complete installation.
- D. 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.
- E. 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.
 - 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 'A " X 2 'A ", 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 1/4 " rod hangers minimum for up to 4"X 4", 3/8 " rod minimum up to 8"X 8", 1/2 11 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 ¹/₂" 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 grommeted 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 1/2 ", 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, 1/4 "thickness minimum, with flush fasteners in nominal 24" lengths. Furnish grommeted 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 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 schedule 80 PVC conduit shall be made 18" inside the concrete envelope. 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.

2.7 SUPPORTS AND HANGERS

- A. Coordinate installation of Supports and Hangers with Division 16 Section "Hangers and Supports for Electrical Systems."
- B. 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.
- C. 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.

- D. 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.
- E. The installing contractor shall provide all necessary supports and braces for raceways, in a rigid and safe installation, complying with all applicable codes.
- F. Individual conduits routed on building walls 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.
- G. Supports may not be fastened to roof decking on drive pins.
- H. 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.
- I. 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.
- J. 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.
- K. 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.
- L. Welding directly on conduit or fittings is not permitted.
- M. 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.
- N. 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.
- 0. 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.
- P. 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.

- Q. The use of perforated iron straps or wire for supporting conduits shall not be permitted.
- R. Where conduits are installed in groups on a common steel channel type support, each conduit shall be secured by Korns, Unistrut, Kindorf clamps or equal.
- S. 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.

2.8 FIRESTOPPING MATERIALS

- A. All conduits and cables penetrating fire 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. The Level 02, Level 03 and Penthouse floor slabs 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 limed 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.

2.9 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.

2.10 COMMUNICATIONS AND A/V OUTLETS

- A. Outlet boxes shall be 5" square by 2-7/8" deep with single or double-gang with raised extension ring.
- B. All communications outlets shall be fed with at least (1) 1-1/4" inch EMT conduits, with an absolute minimum number of bends from the outlet to the cable tray, wire way or homerun directly to the Telecommunications room. Pull boxes must be installed after every 270 degrees of bend (including offsets) or 100 feet of the conduit run.
- C. When mounting the outlet box in a steel studded wall, use a back brace.
- D. Use only compression fittings at joints. No more than one offset in a conduit run, unless additional pull boxes are provided after each offset.

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.
- 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: 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.
- 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. Comply with requirements in Division 16 Section "Hangers and Supports for Electrical Systems" for hangers and supports.
- C. Horizontal runs of conduit between outlet boxes in walls shall not be permitted.
- D. 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.
- E. Conceal conduit and EMT within finished walls, ceilings, and floors unless otherwise indicated. Install conduits parallel or perpendicular to building lines.
- F. Support conduit within 12 inches of enclosures to which attached.
- G. 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.

- H. 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.
- I. Intermediate grade conduit will not be acceptable in place of galvanized rigid steel conduit.
- J. 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.
- K. 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 900 bends.
- L. 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.
- M. 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.
- N. Coordinate with other trades, including metal and concrete deck trades, as necessary to interface installation of electrical raceways and components.
- 0. 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.
- P. Complete installation of electrical raceways before starting installation of cables or wires within raceways.
- Q. Bushings shall be provided on conduits to protect cables transitioning from conduits to cable tray pathway.
- R. Provide plastic bushings on the end of all conduit stub-ups.
- S. 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.
- T. Coordinate with other trades, including metal and concrete deck trades, as necessary to interface installation of electrical raceways and components.
- U. 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.
- V. 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.
- W. 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.

- X. Conduits, cables, raceways, and enclosures are not permitted in concealed locations of metal corrugated sheet decking type roofing.
- Y. 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.
- Z. 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.
- AA. 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.
- BB. 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.
- CC. Stub-ups to Above Recessed Ceilings: Use EMT for raceways.

1. Use a conduit bushing or insulated fitting to terminate stub-ups not terminated in hubs or in an enclosure.

- DD. 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.
- EE. Do not install conduits or raceways on exterior facades or within wall cavities.
- FF. All conduit and PVC conduits installed below grade or below slabs (where indicated) shall be concrete encased.
- GG. Do not drill into bar joists to support raceways or cables.
- HH. All utilities and underground conduits shall be surveyed and recorded on as-built drawings.
- II. All exterior conduits and raceways shall be painted.
- JJ. All floor slabs and concrete walls shall be x-rayed before cutting.
- KK. 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).
- LL. Absolutely no "LB's" are allowed in any communications conduit installation.
- MM. Conduit ends at a wireway will be mechanically fastened, have plastic bushings, and be wire bonded to the wireway.
- NN. 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".
- 00. All underground or underfloor conduits shall be swabbed free of all moisture and debris before

conductors are pulled.

- PP. At least one (1) 1" and three (3) 3/4" conduits shall be stubbed from 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.
- QQ. Coordinate with other trades, including metal and concrete deck trades, as necessary to interface installation of electrical raceways and components.
- RR. All underground conduits shall be buried to minimum depth of 36" from the top of the concrete encasement or raceway to finished grade, unless otherwise noted on plans or specifications. 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.
- SS. Provide uni-strut racks where multiple conduits are supported at one location.
- TT. 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.
- UU. 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.
- VV. 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.
- WW. Surface Raceways:
 - 1. Install surface raceway with a minimum 2-inch radius control at bend points.
 - 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 pigtails 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.

END OF 260533

260550 - 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.

1.2 SUMMARY

- A. Each Contractor shall submit to the Architect and/or Engineer, within thirty days after the date of the Contract, one set of shop drawings and/or manufacturer's descriptive literature on all equipment required for the fulfillment of his contract via eComm. 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.

d.

- 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. Fault Current, Arc Flash and Coordination studies (submit along with switchgear & panelboards).
 - b. Switchboards, distribution panelboards and panelboards.
 - c. Circuit breakers or fusible switches, per each type.
 - d. Dry-type transformers.
 - e. Power and lighting contactors.
 - f. Disconnect switches.
 - g. Enclosed Bus Assemblies
 - h. Fuses, per each type required.
 - i. Magnetic starters, if not submitted with unit equipment by supplier.
 - J. Control components (relays, timers, selector switches, pilots, etc.)
 - k. Motor starters, if not submitted with unit equipment by supplier.
 - I. Building service grounding electrode components.
 - m. Metering devices.
 - n. Bus duct and each type of fitting for bus duct.
 - o. Lightning protection system.
 - p. Transient voltage surge suppression system.
 - q. Grounding system.
 - 2. Raceways
 - a. Conduits and each type of conduit fittings.
 - b. Cable tray and each type of cable 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. Floor trough and each type of floor trough fitting.
 - g. 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 and poke-thrus, each by type, with required accessories.
 - c. Data/voice/video wallplates, each by type.

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. Ballast and drivers, each by type.
- d. Lighting standards or poles.
- e. Photocells, time clocks or other lighting accessories.
- f. 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.
- g. Fire alarm system.
- h. Note: Each system submittal is to be complete with legible cutsheets for all devices, equipment, special wiring, etc. Include system specific wiring schematics showing each device and its specific interconnect/wiring requirements. For rack mounted equipment, provide a scalable elevation drawing with proposed component locations & specific interconnect wiring requirements for each component/panel. Also provide scale building specific layout drawings that indicate device placement, wiring, etc. Refer to the specific system's specification for additional submittal requirements where required.
- 6. Grounding
 - a. Electrodes, bonding devices, terminals, etc.
 - b. Building service grounding electrode components.
 - 7. Dimensioned electrical room plans/equipment layouts
- 8. Fire-stopping
- 9. Lightning Protection
- 10. Seismic Restraints
- 11. Miscellaneous
 - a. Control panel assemblies.
 - b. Non-standard junction/pullboxes.
 - c. Manholes, hand holes, and all outdoor electrical equipment and fittings.
 - d. Floor plan and riser drawings that show the location of all fire alarm devices.
 - e. Floor plan and riser drawings that show the location of all low-voltage systems.
- 12. Systems
 - a. Note: Each system submittal is to be complete with legible cutsheets for all devices, equipment, special wiring, etc. Also provide scale building layout drawings that indicate device placement, wiring, etc. Drawings shall be in digital format and shall include complete (not typical) riser diagrams of all systems. Refer to specific system's specification for additional submittal requirements where required.
 - b. Fire alarm system
 - c. Building paging/intercom audio system
 - d. Telephone system
 - e. Television/video system
 - f. Data network
 - g. Sound reinforcement system(s)
 - h. Wireless intercom system
 - i. Security systems(s)
 - J. All other systems as listed on Systems Responsibility Matrix See Electrical Legend.

13. Special wrenches, tools and keys

1.4 FIRE ALARM SHOP DRAWINGS

- A. The Contractor and equipment supplier shall submit to the Architect and/or Engineer, fire alarm system shop drawings complete with catalog cuts, descriptive literature and complete system wiring diagrams for their review prior to the Contractor's submittal to the Commonwealth's Department of Housing, Buildings and Construction or other governing authority for their review. No work shall be done until drawings are approved by the Kentucky Department of Housing, Buildings and Construction.
- B. Fire alarm drawings shall be created in digital format (CAD or equivalent). Drawings shall include all power supply, battery, and circuit load and voltage drop calculations as required by NFPA. Complete wiring diagrams and proposed device addresses shall be provided.
- C. Shop drawings shall indicate all devices as required to satisfy all local and state mandates, whether indicated on construction drawings or not. Include all components as required for a complete and operational system.

PART 2- PRODUCTS - Not Used

PART 3- EXECUTION — Not Used

END OF 260550

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.

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.
- C. SWBD Switchboard.
- D. ATS Automatic Transfer Switch.
- E. MCC Motor Control Center.
- F. DP Distribution Panel. Electrical distribution panel which is an integral part of a switchboard or switchgear but has its own isolation circuit breaker.
- G. 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.
- H. 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.
- I. E Emergency power system. Annotates that the associated component is part of the Normal Power and Emergency Power distribution systems. In the event of a loss of the supply from the normal power system, the component will receive power from the emergency power system.
- J. BKR Breaker. Switch which interrupts or establishes power flow to its associated load.

K. 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 0.0396inch 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. Multiple Power Source Warning: "DANGER ELECTRICAL SHOCK HAZARD -EQUIPMENT HAS MULTIPLE POWER SOURCES."
- 2. 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.
 - 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 selfadhesive 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. PPS0710D72 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. PAS0710D72 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. All receptacle cover plates shall be marked with their panel and circuit number with clear, machine, printed adhesive labels. Circuit number shall also be hand written inside outlet box with black permanent marker.

- J. 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. Provide electronic Excel files of all directories to owner as part of Close-out Documentation,
- K. Electrical distribution equipment, including branch circuit panelboards switchboards, 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. 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.
- L. Where branch circuit panelboards and switchgear are connected to an emergency source, the lamacoid plate shall be red, and the word "emergency" shall be incorporated into the legend. In health care applications, the NEC designated branch (life safety, critical or equipment branch) shall also be incorporated into the legend, all in 'A" letters. Also provide similar plates and legends for automatic transfer switches, as appropriate. Refer to drawings for further details.
- M. 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.
- N. Verify identity of each item before installing identification products
- 0. 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.
- P. All junction boxes utilized for fire alarm circuits, connections, devices, etc. shall have the cover painted red. Mark over paint with letters "FA".
- Q. All device coverplates which are not engraved shall have clear adhesive labels with panel and circuit number type-written in black lettering.
- R. All systems requiring room names and/or numbers for labeling or programming shall use the owner's actual room name and numbering scheme, not floor plans. All reprogramming shall be included as required to accommodate construction phasing.
- S. 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.
- T. The inside of all junction and backboxes shall be marked with panel and circuit number in permanent marker.
- U. 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.
- V. Identification shall consist of all UPPER CASE LETTERS.
- W. Location: Install identification materials and devices at locations for most convenient viewing without interference with operation and maintenance of equipment.
- X. Apply identification devices to surfaces that require finish after completing finish work.

- Y. Self-Adhesive Identification Products: Clean surfaces before application, using materials and methods recommended by manufacturer of identification devices.
- Z. Attach signs and plastic labels that are not self-adhesive type with mechanical fasteners appropriate to the location and substrate.
- AA. 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.
- BB. Fire alarm system: Install a nameplate on the fire alarm panel to indicate the panelboard and circuit number supplying the fire alarm system.
- CC. 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. Emergency Power.
 - 2. Power.
- DD. Install instructional sign including the color-code for grounded and ungrounded conductors using adhesive-film-type labels.
- EE. Locations of Underground Lines: Identify with underground-line warning tape for power, lighting, communication, and control wiring and optical fiber cable.
- FF. 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.
- GG. Warning Labels for Indoor Cabinets, Boxes, and Enclosures for Power and Lighting: Selfadhesive 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. Power transfer switches.
 - b. Controls with external control power connections.
- HH. 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.
- II. 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.
- JJ. 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.
- KK. 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 260553

260580 - 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.

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.
- G. Cast iron sleeves shall be installed through all walls where conduits enters the building below grade. Sleeves shall be flush with each face of the wall and shall be sufficiently larger than the entering conduit to permit thorough caulking with lead and oakum between conduit and sleeve for waterproofing.
- 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.
- 0. All penetrations shall be patched with materials matching that which has been disturbed.

PART 2- PRODUCTS

2.1 SLEEVES

- A. Sleeves:
 - 1. Steel Pipe Sleeves: ASTM A 53/A 53M, Type E, Grade B, Schedule 40, hot-dipped galvanized, plain ends.
- B. Sleeves for Rectangular Openings:
 - 1. Material: Galvanized sheet steel.
 - 2. Minimum Metal Thickness:
 - a. For sleeve cross-section rectangle perimeter less than 50 inches and with no side larger than 16 inches, thickness shall be 0.052 inch (18 gauge).
 - b. For sleeve cross-section rectangle perimeter 50 inches or more and one or more sides larger than 16 inches, thickness shall be 0.138 inch (10 gauge).

2.2 GROUT

- A. Description: Nonshrink; 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 1" 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 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 were 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 260580

SECTION 260923 - LIGHTING CONTROL

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes the following lighting control devices:
 - 1. Outdoor photoelectric switches.
 - 2. Indoor occupancy sensors.
 - 3. Lighting contactors.
- B. See Division 26 Section "Wiring Devices" for wall-box dimmers, wall-switch occupancy sensors, and manual light switches.

1.2 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Field quality-control test reports.
- C. Operation and maintenance data.

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.

PART 2 - PRODUCTS

2.1 INDOOR OCCUPANCY SENSORS

- 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:
- B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
- C. Basis-of-Design Product: Subject to compliance with requirements, provide the product indicated on Drawings or a comparable product by one of the following:
 - 1. Lithonia Lighting; Acuity Lighting Group, Inc.
 - 2. Sensor Switch, Inc.

- 3. Watt Stopper (The).
- D. General Description: Wall- or ceiling-mounting, solid-state units with a separate relay unit.
 - 1. Operation: Unless otherwise indicated, turn lights on when covered area is occupied and off when unoccupied; with a time delay for turning lights off, adjustable over a minimum range of 1 to 15 minutes.
 - 2. Sensor Output: Contacts rated to operate the connected relay, complying with UL 773A. Sensor shall be powered from the relay unit.
 - 3. Relay Unit: Dry contacts rated for 20-A ballast load at 120- and 277-V ac, for 13-A tungsten at 120-V ac, and for 1 hp at 120-V ac. Power supply to sensor shall be 24-V dc, 150-mA, Class 2 power source as defined by NFPA 70.
 - 4. Mounting:
 - a. Sensor: Suitable for mounting in any position on a standard outlet box.
 - b. Relay: Externally mounted through a 1/2-inch knockout in a standard electrical enclosure.
 - c. Time-Delay and Sensitivity Adjustments: Recessed and concealed behind hinged door.
 - 5. Indicator: LED, to show when motion is being detected during testing and normal operation of the sensor.
 - 6. Bypass Switch: Override the on function in case of sensor failure.
 - 7. Automatic Light-Level Sensor: Adjustable from 2 to 200 fc; Provide 0-10vdc dimming control with adjustable daylighting discount factor.
- E. PIR Type: Ceiling mounting; detect occupancy by sensing a combination of heat and movement in area of coverage.
 - 1. Detector Sensitivity: Detect occurrences of 6-inch minimum movement of any portion of a human body that presents a target of not less than 36 sq. in.
 - 2. Detection Coverage (Room): Detect occupancy anywhere in a circular area of 1000 sq. ft when mounted on a 96-inch high ceiling.
 - 3. Detection Coverage (Corridor): Detect occupancy within 90 feet when mounted on a 10-foot high ceiling.

2.2 OUTDOOR PHOTOELECTRIC SWITCHES

- 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:
- B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
- C. Basis-of-Design Product: Subject to compliance with requirements, provide the product indicated on Drawings or a comparable product by one of the following:
 - 1. Area Lighting Research, Inc.; Tyco Electronics.
 - 2. Grasslin Controls Corporation; a GE Industrial Systems Company.
- 3. Intermatic, Inc.
- 4. Lithonia Lighting; Acuity Lighting Group, Inc.
- 5. Novitas, Inc.
- 6. Paragon Electric Co.; Invensys Climate Controls.
- 7. Square D; Schneider Electric.
- 8. TORK.
- 9. Touch-Plate, Inc.
- 10. Watt Stopper (The).
- D. Description: Solid state, with SPST dry contacts rated for 1800-VA tungsten or 1000-VA inductive, to operate connected relay, contactor coils, or microprocessor input; complying with UL 773A.
 - 1. Light-Level Monitoring Range: 1.5 to 10 fc, with an adjustment for turn-on and turn-off levels within that range, and a directional lens in front of photocell to prevent fixed light sources from causing turn-off.
 - 2. Time Delay: 15-second minimum, to prevent false operation.
 - 3. Surge Protection: Metal-oxide varistor, complying with IEEE C62.41.1, IEEE C62.41.2, and IEEE 62.45 for Category A1 locations.
 - 4. Mounting: Twist lock complying with IEEE C136.10, with base-and-stem mounting or stem-and-swivel mounting accessories as required to direct sensor to the north sky exposure.
- E. Description: Solid state, with SPST dry contacts rated for 1800 VA to operate connected load, relay, or contactor coils; complying with UL 773.
 - 1. Light-Level Monitoring Range: 1.5 to 10 fc, with an adjustment for turn-on and turn-off levels within that range.
 - 2. Time Delay: 30-second minimum, to prevent false operation.
 - 3. Lightning Arrester: Air-gap type.
 - 4. Mounting: Twist lock complying with IEEE C136.10, with base.

2.3 LIGHTING CONTACTORS

- A. Basis-of-Design Product: Subject to compliance with requirements, provide the product indicated on Drawings or a comparable product by one of the following:
 - 1. Allen-Bradley/Rockwell Automation.
 - 2. ASCO Power Technologies, LP; a division of Emerson Electric Co.
 - 3. Eaton Electrical Inc.; Cutler-Hammer Products.
 - 4. GE Industrial Systems; Total Lighting Control.
 - 5. Grasslin Controls Corporation; a GE Industrial Systems Company.
 - 6. Hubbell Lighting.
 - 7. Lithonia Lighting; Acuity Lighting Group, Inc.
 - 8. MicroLite Lighting Control Systems.
 - 9. Square D; Schneider Electric.
 - 10. TORK.
 - 11. Touch-Plate, Inc.
 - 12. Watt Stopper (The).

- B. Description: Electrically operated and electrically held, combination type with fusible switch, complying with NEMA ICS 2 and UL 508.
 - 1. Current Rating for Switching: Listing or rating consistent with type of load served, including tungsten filament, inductive, and high-inrush ballast (ballast with 15 percent or less total harmonic distortion of normal load current).
 - 2. Fault Current Withstand Rating: Equal to or exceeding the available fault current at the point of installation.
 - 3. Enclosure: Comply with NEMA 250.
 - 4. Provide with control and pilot devices as indicated on Drawings matching the NEMA type specified for the enclosure.

2.4 CONDUCTORS AND CABLES

- A. Power Wiring to Supply Side of Remote-Control Power Sources: Not smaller than No. 12 AWG. Comply with requirements in Division 26 Section "Low-Voltage Electrical Power Conductors and Cables."
- B. Classes 2 and 3 Control Cable: Multiconductor cable with stranded-copper conductors not smaller than No. 18AWG. Comply with requirements in Division 26 Section "Low-Voltage Electrical Power Conductors and Cables."
- C. Class 1 Control Cable: Multiconductor cable with stranded-copper conductors not smaller than No.14AWG. Comply with requirements in Division 26 Section "Low-Voltage Electrical Power Conductors and Cables."

PART 3 - EXECUTION

3.1 SENSOR INSTALLATION

- A. Install and aim sensors in locations to achieve not less than 90 percent coverage of areas indicated. Do not exceed coverage limits specified in manufacturer's written instructions.
- B. When requested within 12 months of date of Substantial Completion, provide on-site assistance in adjusting sensors to suit actual occupied conditions. Provide up to two visits to Project during other than normal occupancy hours for this purpose.

3.2 CONTACTOR INSTALLATION

A. Mount electrically held lighting contactors with elastomeric isolator pads, to eliminate structureborne vibration, unless contactors are installed in an enclosure with factory-installed vibration isolators.

3.3 WIRING INSTALLATION

- A. Wiring Method: Comply with Division 26 Section "Low-Voltage Electrical Power Conductors and Cables." Minimum conduit size shall be 1/2 inch.
- B. Wiring within Enclosures: Comply with NECA 1. Separate power-limited and nonpower-limited conductors according to conductor manufacturer's written instructions.
- C. Size conductors according to lighting control device manufacturer's written instructions, unless otherwise indicated.
- D. Splices, Taps, and Terminations: Make connections only on numbered terminal strips in junction, pull, and outlet boxes; terminal cabinets; and equipment enclosures.

3.4 IDENTIFICATION

- A. Identify components and power and control wiring according to Division 26 Section "Identification for Electrical Systems."
 - 1. Identify controlled circuits in lighting contactors.
 - 2. Identify circuits or luminaries controlled by photoelectric and occupancy sensors at each sensor.
- B. Label time switches and contactors with a unique designation.

3.5 FIELD QUALITY CONTROL

- A. Perform the following field tests and inspections and prepare test reports:
 - 1. After installing time switches and sensors, and after electrical circuitry has been energized, adjust and test for compliance with requirements.
 - 2. Operational Test: Verify operation of each lighting control device, and adjust time delays.
- B. Lighting control devices that fail tests and inspections are defective work.

END OF SECTION 260923

262416 - PANELBOARDS

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.

1.2 SUMMARY

- A. Section Includes:
 - 1. Distribution panelboards.
 - 2. Lighting and appliance branch-circuit panelboards.

1.3 DESCRIPTION OF WORK

- A. All panelboards shall be of the circuit breaker type and shall be of one manufacturer.
- B. Branch panelboards shall be as indicated on the drawings and as specified herein. The lighting panelboards shall be of the dead-front, quick-make, quick-break, bolt-on circuit breaker type, with trip indicating and trip free handles. All circuits shall be clearly and properly numbered and shall be provided with thermal magnetic protection.
- C. The panelboards shall be enclosed in code gauge, galvanized steel cabinets with smooth finished hinged doors without visible external fasteners and heavy chrome locks. Provide baked-on grey enamel finish, in accord with ANSI 61. Panels shall be constructed in accord with Federal Specification W-P-115B Type 1 Class 1, UL67, UL50, NEMA P31, and NFPA 70. Locks shall all be keyed alike.
- D. Each door shall have a directory card inside, covered with a plastic shield, with typewritten circuit numbers and description indicated. Room numbers shall be coordinated with final room numbers as selected by Owner, not numbers on Contract Documents.
- E. Panelboard trim for surface or flush panels shall be double-hinged type, to allow exposure of dead-front breaker portion behind locked door, with screw-fastened gutter trim that is hinged to allow full access to wiring gutters.
- F. Special Note: The room numbers used to fill out the panel directories shall match the actual final name and numbering scheme selected by the Owner. They shall not be filled out per the construction drawing numbering scheme, unless the Contractor is directed to do so by the Architect or Engineer.
- G. Branch panelboards shall be surface or flush mounted as indicated on the Contract Drawings. Flush panels trims shall be tight to wall and interior barriers, with no gaps allowing access to live parts. Oversize trims will not be acceptable.
- H. Note: Where mounted in groups, align top of trim or tub for all panels in an area. Exact mounting height of topline shall be as directed by the Engineer.

- I. All main bus and connections thereto in panelboards shall be copper. All bus bars shall extend full length of panelboards.
- J. All panelboards shall have full size un-insulated copper ground busses and insulated full neutral busses.
- K. All panelboards shall be provided with an SPD per Specification 16285, Surge Protection for Low-Voltage Electrical Power Circuits.
- 1.4 DEFINITIONS
 - A. SVR: Suppressed voltage rating.
 - B. GFCI: Ground-fault circuit interrupter
- 1.5 ACTION SUBMITTALS
 - A. Product Data: For each type of panelboard, switching and overcurrent protective device, surge suppression device, accessory, and component indicated. Include dimensions and manufacturers' technical data on features, performance, electrical characteristics, ratings, and finishes.
 - B. Shop Drawings: For each panelboard and related equipment.
 - 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 panelboards and 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.
- 1.6 INFORMATIONAL SUBMITTALS
 - A. Panelboard Schedules: For installation in panelboards. Submit final version after load balancing.
- 1.7 CLOSEOUT SUBMITTALS
 - A. Operation and Maintenance Data: For panelboards and components to include in emergency, operation, and maintenance manuals. In addition to items specified in Section 017823
 "Operation and Maintenance Data," include the following:
 - 1. Routine maintenance requirements for panelboards and all installed components.
 - 2. Manufacturer's written instructions for testing and adjusting overcurrent protective devices.
- 1.8 MAINTENANCE MATERIAL SUBMITTALS
 - A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Keys: Two spares for each type of panelboard cabinet lock.

1.9 QUALITY ASSURANCE

- A. Testing Agency Qualifications: Member company of NETA or an NRTL.
 - 1. Testing Agency's Field Supervisor: Currently certified by NETA to supervise on-site testing.
- B. Source Limitations: Obtain panelboards, overcurrent protective devices, components, and accessories from single source from single manufacturer.
- C. Product Selection for Restricted Space: Drawings indicate space available for panelboards including clearances between panelboards and adjacent surfaces and other items. Furnish and install equipment to comply with NEC clearances.
- 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 1.
- F. Comply with NFPA 70.
- 1.10 DELIVERY, STORAGE, AND HANDLING
 - A. Handle and prepare panelboards for installation according to NECA 407 and NEMA PB 1.

1.11 PROJECT CONDITIONS

A. Environmental Limitations: Do not deliver or install panelboards until spaces are enclosed and weathertight, wet work in spaces is complete and dry, work above panelboards 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.

1.12 COORDINATION

- A. Coordinate layout and installation of panelboards 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.

1.13 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 panelboards, 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 panelboards, 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 GENERAL REQUIREMENTS FOR PANELBOARDS
 - A. All panelboards shall be of the circuit breaker type and shall be of one manufacturer.
 - B. Enclosures: Flush- and surface-mounted cabinets. Box width shall not exceed 20" wide. Rated for environmental conditions at installed location.
 - 1. Indoor Dry and Clean Locations: NEMA 250, Type 1.
 - C. Type 1 Boxes
 - 1. Boxes shall be hot zinc dipped galvanized steel constructed in accordance with UL 50 requirements. Unpainted galvannealed steel is not acceptable.
 - 2. Boxes shall have removable end walls. End walls shall not be provided with concentric knockouts. Boxes shall have welded interior mounting studs. Interior mounting brackets are not required.
 - 3. Front: Secured to box with concealed trim clamps. For surface-mounted fronts, match box dimensions; for flush-mounted fronts, overlap box.
 - 4. Hinged Front Cover: Entire front trim hinged to box and with standard door within hinged trim cover.
 - 5. Gutter Extension and Barrier: Same gage and finish as panelboard enclosure; integral with enclosure body. Arrange to isolate individual panel sections.
 - 6. Finishes: Panels, Back Boxes and Trim: Galvanized Steel, factory finished immediately after cleaning and pretreating with manufacturer's standard two-coat, baked-on finish consisting of prime coat and thermosetting topcoat.
 - 7. Directory Card: Inside panelboard door, mounted in metal frame with transparent protective cover.
 - 8. All lock assemblies shall be keyed alike.
 - D. Incoming Mains Location: Top and bottom to match feeder conduit entry. Feeders routed through the side gutters to reach the top or bottom main breakers from the opposite end of the panel are not acceptable.
 - E. Phase, Neutral, and Ground Busses:
 - 1. Material: Fully plated, hard-drawn copper, 98 percent conductivity.
 - 2. Equipment Ground Bus: Extend full length of panelboard and adequate for feeder and branch-circuit equipment grounding conductors; bonded to box.

- 3. Isolated Ground Bus: Adequate for branch-circuit isolated ground conductors; insulated from box. Provide where show on drawings.
- 4. Extra-Capacity Neutral Bus: Neutral bus rated 200 percent of phase bus and UL listed as suitable for nonlinear loads. Provide when supplied by K rated transformers.
- 5. Split Bus: Vertical buses divided into individual vertical sections.
- F. Conductor Connectors: Suitable for use with conductor material and sizes.
 - 1. Main and Neutral Lugs: Mechanical type.
 - 2. Ground Lugs and Bus-Configured Terminators: Mechanical type.
 - 3. Feed-Through Lugs: Mechanical type, suitable for use with conductor material. Locate at opposite end of bus from incoming lugs or main device.
 - 4. Subfeed (Double) Lugs: Mechanical type suitable for use with conductor material. Locate at same end of bus as incoming lugs or main device.
 - 5. Extra-Capacity Neutral Lugs: Rated 200 percent of phase lugs mounted on extra-capacity neutral bus.
- G. Future Devices: Mounting brackets, bus connections, filler plates, and necessary appurtenances required for future installation of devices.
- H. Panelboard Short-Circuit Current Rating: Fully rated to interrupt symmetrical short-circuit current available at terminals.
- 2.2 DISTRIBUTION PANELBOARDS
 - A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Square D; a brand of Schneider Electric.
 - 2. Eaton Electrical Inc.; Cutler-Hammer Business Unit.
 - 3. General Electric Company; GE Consumer & Industrial Electrical Distribution.
 - 4. Siemens
 - B. Panelboards: NEMA PB 1, power and feeder distribution type.
 - C. Doors: Secured with vault-type latch with tumbler lock; keyed alike. For doors more than 36 inches (914 mm) high, provide two latches, keyed alike.
 - D. Branch Overcurrent Protective Devices for Circuit-Breaker Frame Sizes 125 A and Smaller: Bolt-on circuit breakers.
 - E. Branch Overcurrent Protective Devices for Circuit-Breaker Frame Sizes Larger Than 125 A: Bolt-on circuit breakers; plug-in circuit breakers where individual positive-locking device requires mechanical release for removal.

2.3 LIGHTING AND APPLIANCE BRANCH-CIRCUIT PANELBOARDS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Square D; a brand of Schneider Electric.
 - 2. Eaton Electrical Inc.; Cutler-Hammer Business Unit.
 - 3. General Electric Company; GE Consumer & Industrial Electrical Distribution.
 - 4. Siemens
- B. Panelboards: NEMA PB 1, lighting and appliance branch-circuit type.

- C. Branch Overcurrent Protective Devices: Bolt-on circuit breakers, replaceable without disturbing adjacent units.
- D. Doors: Concealed hinges; secured with flush latch with tumbler lock; keyed alike.
- E. Interior:
 - 1. Continuous main current ratings, as indicated on associated drawings.
 - 2. Short circuit rating as shown on the schedules.
 - 3. Provide one (1) continuous bus bar per phase. Each bus bar shall have sequentially phased branch circuit connectors limited to bolt-on branch circuit breakers. The bussing shall be fully rated. Panelboard bus current ratings shall be determined by heat-rise tests conducted in accordance with UL 67. Bussing shall be plated copper. Bus bar plating shall run the entire length of the bus bar. Panelboards shall be suitable for use as Service Equipment when application requirements comply with UL 67 and NEC Articles 230-F and -G.
 - 4. All current-carrying parts shall be insulated from ground and phase-to-phase by high dielectric strength thermoplastic.
 - 5. A solidly bonded copper equipment ground bar shall be provided.
 - 6. Split solid neutral shall be plated and located in the mains compartment up to 250 amperes so all incoming neutral cable may be of the same length.
 - 7. Interior trim shall be of dead-front construction to shield user from energized parts. Dead-front trim shall have filler plates covering unused mounting space.
 - 8. Nameplates shall contain system information and catalog number or factory order number. Interior wiring diagram, neutral wiring diagram, CSA/UL Listed label and short circuit current rating shall be displayed on the interior or in a booklet format.

2.4 DISCONNECTING AND OVERCURRENT PROTECTIVE DEVICES

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Square D; a brand of Schneider Electric.
 - 2. Eaton Electrical Inc.; Cutler-Hammer Business Unit.
 - 3. General Electric Company; GE Consumer & Industrial Electrical Distribution.
 - 4. Siemens
- B. Molded-Case Circuit Breaker (MCCB): Comply with UL 489, with interrupting capacity to meet available fault currents.
 - 1. Circuit breakers shall be CSA and UL Listed with amperage ratings, interrupting ratings, and number of poles as indicated on the panelboard schedules.
 - 2. Molded case branch circuit breakers shall have bolt-on type bus connectors.
 - 3. Circuit breakers shall have an over-center toggle mechanism which will provide quick-make, quick-break contact action. Circuit breakers shall have thermal and magnetic trip Elements in each pole. Two- and three-pole circuit breakers shall have common tripping of all poles.
 - 4. There shall be two forms of visible trip indication. The circuit breaker handle shall reside in a position between ON and OFF. In addition, there shall be a red indicator appearing in the clear window of the circuit breaker housing.
 - 5. The exposed faceplates of all branch circuit breakers shall be flush with one another.
 - 6. Lugs shall be UL Listed to accept solid or stranded copper and aluminum conductors.

- 7. 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.
- 8. Adjustable Instantaneous-Trip Circuit Breakers: Magnetic trip element with front-mounted, field-adjustable trip setting.
- 9. Electronic trip circuit breakers with rms sensing; field-replaceable rating plug or field-replicable electronic trip; and the following field-adjustable settings:
- 10. Instantaneous trip.
- 11. Long- and short-time pickup levels.
- 12. Long- and short-time time adjustments.
- 13. Current-Limiting Circuit Breakers: Frame sizes 400 A and smaller; let-through ratings less than NEMA FU 1, RK-5.
- 14. GFCI Circuit Breakers: Single- and two-pole configurations with Class A ground-fault protection (6-mA trip).
- 15. Ground-Fault Equipment Protection (GFEP) Circuit Breakers: Class B ground-fault protection (30-mA trip).
- 16. Arc-Fault Circuit Interrupter (AFCI) Circuit Breakers: Comply with UL 1699; 120/240-V, single-pole configuration.
- 17. Molded-Case Circuit-Breaker (MCCB) Features and Accessories:
 - a. Standard frame sizes, trip ratings, and number of poles.
 - b. Lugs: Mechanical style, suitable for number, size, trip ratings, and conductor materials.
 - c. Application Listing: Appropriate for application; Type SWD for switching fluorescent lighting loads; Type HID for feeding fluorescent and high-intensity discharge (HID) lighting circuits.
 - d. Ground-Fault Protection: Integrally mounted relay and trip unit with adjustable pickup and time-delay settings, push-to-test feature, and ground-fault indicator.
 - e. Shunt Trip: 120 V trip coil energized from separate circuit, set to trip at 75 percent of rated voltage.
 - f. Multipole units enclosed in a single housing or factory assembled to operate as a single unit.

2.5 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 panelboard. Include relay and meter test plugs suitable for testing panelboard meters and switchboard class relays.

PART 3- EXECUTION

3.1 EXAMINATION

- A. Receive, inspect, handle, and store panelboards according to NECA 407.
- B. Examine panelboards before installation. Reject panelboards that are damaged or rusted or have been subjected to water saturation.
- C. Examine elements and surfaces to receive panelboards for compliance with installation tolerances and other conditions affecting performance of the Work.
- D. Proceed with installation only after unsatisfactory conditions have been corrected.
- 3.2 INSTALLATION

- A. Install panelboards and accessories according to NECA 407 and NEMA PB 1.1.
- B. Equipment Mounting: Install floor-mounted panels on concrete bases, 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 (450-mm) centers around full perimeter of base.
 - 2. For panelboards, 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 panelboards.
 - 5. Attach panelboard to the vertical finished or structural surface behind the panelboard.
- C. Temporary Lifting Provisions: Remove temporary lifting eyes, channels, and brackets and temporary blocking of moving parts from panelboards.
- D. Mount top of trim 90 inches above finished floor unless otherwise indicated.
- E. Mount panelboard cabinet plumb and rigid without distortion of box. Mount recessed panelboards with fronts uniformly flush with wall finish and mating with back box.
- F. Install overcurrent protective devices and controllers not already factory installed. Set field-adjustable, circuit-breaker trip ranges.
- G. Install filler plates in unused spaces.
- H. Stub four (4) 1-inch and two (2) 1-1/4"-inch empty conduits from recessed panelboard into accessible ceiling space or space designated to be ceiling space in the future.
- I. Arrange conductors in gutters into groups and bundle and wrap with wire ties after completing load balancing.
- J. Comply with NECA 1.

3.3 IDENTIFICATION

- A. Each door shall have a directory card inside, covered with a plastic non-yellowing shield. Directory Card to indicate installed circuit loads after balancing panelboard loads; incorporate Owner's final room designations. Obtain approval before installing. Use a computer to create directory in Microsoft Excel; handwritten directories are not acceptable. Digital versions to be provided to Owner.
- B. Panelboard Nameplates: Label each panelboard with a nameplate complying with requirements for identification specified in Section 16075.
- C. Device Nameplates: Label each branch circuit device in distribution panelboards with a nameplate complying with requirements for identification specified in Section 16075.

3.4 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.

DIVISION 26 ELECTRICAL

- B. Acceptance Testing Preparation:
 - 1. Test insulation resistance for each panelboard bus, component, connecting supply, feeder, and control circuit.
 - 2. Test continuity of each circuit.
- C. Tests and Inspections:
 - 1. 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.
- D. Panelboards will be considered defective if they do not pass tests and inspections.
- E. Prepare test and inspection reports, including a certified report that identifies panelboards included and that describes scanning results. Include notation of deficiencies detected, remedial action taken, and observations after remedial action.

3.5 CLEANING

A. On completion of installation, inspect interior and exterior of panelboards. Remove paint splatters and other spots. Vacuum dirt and debris; do not use compressed air to assist in cleaning. Repair exposed surfaces to match original finish.

3.6 ADJUSTING

- A. Adjust moving parts and operable component to function smoothly, and lubricate as recommended by manufacturer.
- B. Set field-adjustable circuit-breaker trip ranges as specified in Section 16460.
- C. Load Balancing: After Substantial Completion, but not more than 60 days after Final Acceptance, measure load balancing and make circuit changes.
 - 1. Measure as directed during period of normal system loading.
 - 2. Perform load-balancing circuit changes outside normal occupancy/working schedule of the facility and at time directed. Avoid disrupting critical 24-hour services such as fax machines and on-line data processing, computing, transmitting, and receiving equipment.
 - 3. After circuit changes, recheck loads during normal load period. Record all load readings before and after changes and submit test records.
 - 4. Tolerance: Difference exceeding 20 percent between phase loads, within a panelboard, is not acceptable. Rebalance and recheck as necessary to meet this minimum requirement.

END OF 262416

SECTION 26 25 00

BUSWAY - LOW VOLTAGE (POW-R-WAY III)

PART 1 GENERAL

1.01 SCOPE

A. The Contractor shall furnish and install the busway system including all necessary fittings, hangers and accessories as specified herein and as shown on the contract drawings.

1.02 REFERENCES

- A. The low voltage busway and all components shall be designed, manufactured and tested in accordance with the latest applicable following standards of ANSI and NEMA:
 - 1. NEMA BU.1
 - 2. ANSI/UL 857
 - 3. CSA

1.03 SUBMITTALS – FOR REVIEW/APPROVAL

- A. The following information shall be submitted to the Engineer:
 - 1. Master drawing index
 - 2. Isometric drawing of each busway run
 - 3. Component list
 - 4. Busway ratings including:
 - a. Short-circuit rating
 - b. Voltage
 - c. Continuous current
 - 5. Major component ratings including:
 - a. Voltage
 - b. Continuous current
 - c. Interrupting ratings
 - 6. Cable terminal sizes
 - 7. Product data sheets
- 1.04 SUBMITTALS FOR CONSTRUCTION
 - A. The following information shall be submitted for record purposes:
 - 1. Final as-built drawings and information for items listed in Paragraph 1.04, and shall incorporate all changes made during the manufacturing process
 - 2. Certified production test reports
 - 3. Installation information
 - 4. Seismic certification and equipment anchorage details

BUSWAY – LOW VOLTAGE SECTION 26 25 00

1.05 QUALIFICATIONS

- A. The manufacturer of the assembly shall be the manufacturer of the major components within the assembly.
- B. For the equipment specified herein, the manufacturer shall be ISO 9001 or 9002 certified.
- C. The manufacturer of this equipment shall have produced similar electrical equipment for a minimum period of five (5) years. When requested by the Engineer, an acceptable list of installations with similar equipment shall be provided demonstrating compliance with this requirement.

1.06 REGULATORY REQUIREMENTS

A. The busway shall bear a UL label.

1.07 DELIVERY, STORAGE AND HANDLING

A. Equipment shall be handled and stored in accordance with manufacturer's instructions. One (1) copy of these instructions shall be included with the equipment at time of shipment.

1.08 OPERATION AND MAINTENANCE MANUALS

A. Equipment operation and maintenance manuals shall be provided with each assembly shipped, and shall include instruction leaflets and instruction bulletins for the complete assembly and each major component.

1.09 EXTRA PRODUCTS

- A. Spare parts shall be furnished for each rating of busway, consisting of:
 - 1. One set of joint covers for each busway

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Eaton
- B. SQUARE D
- C. GE

The listing of specific manufacturers above does not imply acceptance of their products that do not meet the specified ratings, features and functions. Manufacturers listed above are not relieved from meeting these specifications in their entirety. Products in compliance with the specification and manufactured by others not named will be considered only if pre-approved by the Engineer ten (10) days prior to bid date.

2.02 RATINGS

A. The busway shall be Eaton type Pow-R-Way III with voltage and current ratings as indicated on the contract drawings.

3-phase, 4-wire with 200% neutral

B. The busway shall have a minimum of 6-cycle short-circuit rating of 85 kA RMS symmetrical for ratings through 800 Amp, 100 kA RMS symmetrical for ratings through 1350 Amp, 125 kA RMS symmetrical for ratings through 1600 Amp, 150 kA RMS symmetrical ratings through 2500 Amp, and 200 kA RMS symmetrical for ratings through 5000 Amp.

BUSWAY – LOW VOLTAGE SECTION 26 25 00

2.03 CONSTRUCTION

A. The busway and associated fittings shall consist of copper conductors totally enclosed in a 2-piece extruded aluminum housing. Outdoor feeder, indoor feeder and indoor plug-in busway shall be interchangeable at the same rating without the use of adapters or special splice plates. Where indicated on the drawings provide indoor, sprinkler-proof plug-in busway. Fittings –(elbows, tees, flanges, etc.) shall be identical for use with both the plug-in and feeder types of busway. The busway shall be capable of being mounted flat-wise, edgewise, or vertically without derating. The busway shall consist of standard 10-foot sections with special sections and fittings provided to suit the installation. Horizontal runs shall be suitable for hanging on 10-foot maximum centers. Vertical runs shall be suitable for mounting on 16-foot maximum centers. Provide one (1) hanger for every ten (10) feet of horizontally mounted duct. On vertical runs provide one adjustable hanger per floor.

2.04 BUS

- A. Bus bars shall be fabricated from high strength 98% conductivity copper and suitably plated at all electrical contact surfaces.
- B. Bus bars shall be insulated over their entire length, except at joints and contact surfaces, with a UL listed insulating material consisting of a thermo set epoxy applied by fluidized bed process. Tape or heat-shrink sleeve insulation, or any other method of insulation, which can allow air-gaps or insulation breakdown, shall not be acceptable.
- C. The busway shall be capable of carrying rated current continuously without exceeding a temperature rise of 55 degrees C based on a 40 degrees C ambient.

2.05 BUS JOINTS

A. Each busway section shall be furnished complete with joint hardware and covers. The busway joints shall be a single-bolt, non-rotating, removable bridge design. All bridge joints shall be furnished with torque-indicating double head joint bolts and Belleville washers. The bridge joint shall utilize a captive nut retainer on the opposite side of the torque-indicating bolt. The bridge joint design shall ensure proper installation without the use of a torque wrench, and provide visual indication that the joint has been tightened to the proper torque value. Each busway joint shall allow for a minimum length adjustment of +/- 0.5 inches. De-energization of busway shall not be required for safe testing of joint tightness.

2.06 HOUSING

- A. The busway housing shall be a 2-piece design fabricated from extruded aluminum. The 2-piece housing shall be bolted together, along the bottom flange, using grade 5, 1/4x20 zinc-plated fasteners on 3-inch centers for maximum mechanical strength. The busway enclosure finish shall be ANSI 61 gray baked epoxy powder paint applied by an electrostatic process.
- B. Outdoor feeder busway housing shall be identical to indoor feeder busway housings, and shall be UL listed for outdoor use. Busway shall be completely weatherized at the factory, and designed such that only caulking of protective joint covers are required for outdoor application.

2.07 PLUG-IN BUSWAY

A. Where required, busway shall be of the plug-in type. Plug-in busway shall be available in standard 2-, 4-, 6-, 8- and 10-foot lengths, with plug-in openings provided on both sides of the busway sections on 24-inch centers. Plug-in covers shall prohibit dirt and debris from entering contact plug-in openings in the busway. The design shall allow for ten (10) hinged cover outlets per ten (10) feet of plug-in length, and covers shall be field-convertible to hinge on either side. Covers for plug-in openings shall have a positive screw close feature and provisions for installation of power company seals. The contact surfaces for bus plug stabs shall be silver-plated and of the same material, thickness, and rating as the phase bars. The tabs shall be welded to the bus bars. A standard housing ground connection shall be supplied in each plug-in opening.

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Positive mechanical guides for plug-in units shall be provided at each plug-in opening to facilitate unit alignment and prevent improper installation.

- B. Where required, plug-in units of the types and ratings indicated on the plans and specifications shall be supplied. Plug-in units shall be mechanically interlocked with the busway housing to prevent their installation or removal while the switch is in the "ON" position. The enclosure of any plug-in unit shall make positive ground connection to the duct housing before the stabs make contact with the bus bars. All plug-in units shall be equipped with an interlock that can be defeated to prevent the cover from being opened while the switch is in the "ON" position and to prevent accidental closing of the switch while the cover is open. The plugs shall be provided with a means for padlocking the cover closed and padlocking the disconnect device in the "OFF" position. The operating handle and mechanism shall remain in control of the disconnect device at all times, permitting its easy operation from the floor by means of a hook stick or chain. All plug-in units shall be interchangeable without alteration or modification of plug-in duct.
- C. Circuit breaker-type plugs shall have an interrupting rating of not less than 22,000 symmetrical RMS amperes or be series-rated as otherwise shown in the contract document and shall meet all requirements of UL Standard 489. surge protective devices

PART 3 EXECUTION

3.01 FACTORY TESTING

- A. Standard factory tests shall be performed on the equipment provided under this section. All tests shall be in accordance with the latest version of ANSI and NEMA standards.
- B. The manufacturer shall provide three (3) certified copies of factory test reports.

3.02 INSTALLATION

A. The Contractors shall install all equipment per the manufacturer's recommendations and the contract drawings.

262716 - 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.

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 clocks, speakers, 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. NEMA 1 or 1A outlet boxes or pull or junction boxes shall be as manufactured by Appleton, Steel City, T & B, or approved equivalent.
 - 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.
- N. 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

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Convenience Outlets 1'-6"	
Convenience Outlets - Above CountersBo	ottom at 2" above top of backsplash
TV Outlets	1'-6"
TV Outlets - At Wall Brackets	
Desk Telephones	1'-6"
Wall-Mounted Telephone	
Weatherproof Outlets	
Disconnects, Branch Panelboards	
Fire Alarm Manual Stations	
Fire Alarm Audio and/or Visual Unit 80" AFF to bottom	
of device or 6" below ceiling, whichever is lower	

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.

2.2 COMMUNICATIONS AND A/V OUTLETS

- A. Outlet boxes shall be 5" square by 2-7/8" deep with single or double-gang with raised extension ring.
- B. All communications outlets shall be fed with at least (1) 1-1/4" inch EMT conduits, with an absolute minimum number of bends from the outlet to the cable tray, wire way or homerun directly to the Telecommunications room. Pull boxes must be installed after every 270 degrees of bend (including offsets) or 100 feet of the conduit run.
- C. When mounting the outlet box in a steel studded wall, use a back brace.

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.

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- B. Comply with requirements in Section 16050 "Hangers and Supports for Electrical Systems" for hangers and supports.
- C. Comply with requirements in Section 16130 "Raceways and Boxes for Electrical Systems."
- D. Install electrical boxes as required for splices, taps, wire pulling, equipment connections.
- E. 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.
- F. Do not fasten boxes to ceiling support wires or other piping systems.
- G. Support all boxes independently of conduit.
- H. 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 262716

DIVISION 26 ELECTRICAL

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.

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.
 - 2. Twist-locking receptacles.
 - 3. Receptacles with integral surge-suppression units.
 - 4. Isolated-ground receptacles.
 - 5. Tamper-resistant receptacles.
 - 6. Weather-resistant receptacles.
 - 7. Snap switches and wall-box dimmers.
 - 8. Cord and plug sets.
 - 9. Floor service outlets, poke-through assemblies, service poles, and multioutlet assemblies.

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.

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, 125V, 20A: Comply with NEMA WD 1, NEMA WD 6 Configuration 5-20R, UL 498, and FS W-C-596.
 - 2. Isolated-Ground, Duplex Convenience Receptacles, 125 V, 20 A: Comply with NEMA WD 1, NEMA WD 6 Configuration 5-20R, UL 498, and FS W-C-596.
 - a. Description: Straight blade; equipment grounding contacts shall be connected only to the green grounding screw terminal of the device and with inherent electrical isolation from mounting strap. Isolation shall be integral to receptacle construction and not dependent on removable parts.

3. Tamper-Resistant Convenience Receptacles, 125 V, 20A: Comply with NEMA WD 1, NEMA WD 6 Configuration 5-20R, UL 498 Supplement sd, and FS W-C-596.

D. SPD Receptacles

- 1. General Description: Comply with NEMA WD 1, NEMA WD 6, UL 498, UL 1449, and FS W-C-596, with integral SPD in line to ground, line to neutral, and neutral to ground.
 - a. SPD Components: Multiple metal-oxide varistors; with a nominal clamp-level rating of 400 V and minimum single transient pulse energy dissipation of 240 J, according to IEEE C62.41.2 and IEEE C62.45.
 - b. Active SPD Indication: Visual and audible, with light visible in face of device to indicate device is "active" or "no longer in service."
- 2. Duplex SPD Convenience Receptacles: Straight blade, 125V, 20A; NEMA WD 6 Configuration 5-20R.

2.3 DEVICES

ТҮРЕ	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 USB- Provide Hubbell USB15X2W USB Duplex Receptacle where designated with "USB".					
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 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

NOTES:

- 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
- ! SEE PART 2.5, COLOR.

2.4 SMALL MOTOR CONTROL SWITCHES

A. For small line-to-neutral motor loads of 3/4 HP or less, single phase, rated at 120 or 277 volts, provide snap-type, HP rated motor starter switch with thermal overloads. Overload heaters sized to match the motor nameplate amperes and the ambient temperature shall be provided. Provide with NEMA 1, NEMA 3R or other enclosure suitable for the location and atmosphere. All manual starters in finished areas shall be in flush-mounted enclosures. If the motor to be controlled is not equipped with internal thermal overload protection, overload heaters sized to match the motor nameplate amperes and the ambient temperature shall be provided.

2.5 COLOR

- A. Color of devices shall be Ivory or as selected by the architect during Shop Drawing Review. 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.

2.6 PLATES AND COVERS

A. Unless otherwise specified or noted, all wiring device plates and covers shall be smooth 304 Stainless Steel. Plates shall have circuit designation engraved in the face.

- B. Plates for use on emergency outlets shall be engraved with the word "Emergency". Plates for use on isolated ground outlets shall be engraved with the words "Isolated Ground".
- C. Cover plates shall be of one manufacturer insofar as possible.
- D. 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.
- E. Weatherproof switch plates for toggle-handle switches shall be clear silicone rubber, for standard outlet boxes. Hubbell 1795 or equivalent P & S or Leviton.
- F. 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.

2.8 FLOOR BOXES

- 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. In general, floor boxes that are to contain multiple services such as power, data, voice, video, etc., shall be constructed of stamped steel and heavy thermoplastic with barriers or compartments to separate power from signal services per National Electrical Code.
 - 2. Provide floor boxes with proper trim for carpet, wood, terrazo, tile or concrete floors, wiring slots, dust covers and proper device plates to hold outlets, jacks, etc. They shall be fully adjustable. Conduit rough-in shall be as required. All tops shall be capable of receiving an insert of the surrounding floor material.
 - 3. Outlets for multi-service floor boxes shall be as specified elsewhere in these specifications.
 - 4. Set boxes dead level with flooring and provide proper support by thickening concrete slab, welding angle iron across joists below or other approved means.

2.9 TWIST-LOCKING RECEPTACLES

- A. Single Convenience Receptacles, 125V, 20A: Comply with NEMA WD 1, NEMA WD 6 Configuration L5-20R, and UL 498.
- B. Isolated-Ground, Single Convenience Receptacles, 125 V, 20 A:
- C. Description:
 - 1. Comply with NEMA WD 1, NEMA WD 6 Configuration L5-20R, and UL 498.
 - 2. Equipment grounding contacts shall be connected only to the green grounding screw

terminal of the device and with inherent electrical isolation from mounting strap. Isolation shall be integral to receptacle construction and not dependent on removable parts.

2.10 PENDANT CORD-CONNECTOR DEVICES

- A. Description:
 - 1. Matching, locking-type plug and receptacle body connector.
 - 2. NEMA WD 6 Configurations L5-20P and L5-20R, heavy-duty grade, and FS W-C-596.
 - 3. Body: Nylon, with screw-open, cable-gripping jaws and provision for attaching external cable grip.
 - 4. External Cable Grip: Woven wire-mesh type made of high-strength, galvanized-steel wire strand, matched to cable diameter, and with attachment provision designed for corresponding connector.

2.11 CORD AND PLUG SETS

- A. Description:
 - 1. Match voltage and current ratings and number of conductors to requirements of equipment being connected.
 - 2. Cord: Rubber-insulated, stranded-copper conductors, with Type SOW-A jacket; with green-insulated grounding conductor and ampacity of at least 130 percent of the equipment rating.
 - 3. Plug: Nylon body and integral cable-clamping jaws. Match cord and receptacle type for connection.

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 adhesive tape. Select face plates shall be engraved. Refer to drawings.
- 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 AVVG 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. Dimmers:
 - 1. Install dimmers within terms of their listing.
 - 2. Verify that dimmers used for fan speed control are listed for that application.
 - 3. Install unshared neutral conductors on line and load side of dimmers according to manufacturers' device listing conditions in the written instructions.

- N. Adjust locations of floor service outlets and service poles to suit arrangement of partitions and furnishings.
- 3.2 IDENTIFICATION: Comply with Division 16 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 262726

262813 - FUSES

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.

1.2 SUMMARY

- A. Section Includes:
 - 1. Cartridge fuses rated 600V ac and less for use in control circuits, enclosed switches, panelboards, switchboards, enclosed controllers and motor-control centers.
 - 2. Spare fuse cabinet.

1.3 SUBMITTALS

- A. Product Data: Include the following for each fuse type indicated:
 - 1. Dimensions and manufacturer's technical data on features, performance, electrical characteristics, and ratings.
 - 2. Let-through current curves for fuses with current-limiting characteristics.
 - 3. Time-current curves, coordination charts and tables, and related data.
 - 4. Fuse size for elevator feeders and elevator disconnect switches.
- B. Ambient Temperature Adjustment Information: If ratings of fuses have been adjusted to accommodate ambient temperatures, provide list of fuses with adjusted ratings.
 - 1. For each fuse having adjusted ratings, include location of fuse, original fuse rating, local ambient temperature, and adjusted fuse rating.
 - 2. Provide manufacturer's technical data on which ambient temperature adjustment calculations are based.
- C. Operation and Maintenance Data: For fuses to include in emergency, operation, and maintenance manuals.
 - 1. In addition to items specified in Division 1 Section "Closeout Procedures," include the following:
 - a. Let-through current curves for fuses with current-limiting characteristics.
 - b. Time-current curves, coordination charts and tables, and related data.
 - c. Ambient temperature adjustment information.

1.4 QUALITY ASSURANCE

- A. Source Limitations: Obtain fuses, for use within a specific product or circuit, from single source from single manufacturer.
- 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:
 - 1. NEMA FU 1 Low Voltage Cartridge Fuses.
 - 2. NFPA 70 National Electrical Code.
 - 3. UL 198C High-Interrupting-Capacity Fuses, Current-Limiting Types.
 - 4. UL 198E Class R Fuses.
 - 5. UL 512—Fuseholders.

1.5 COORDINATION

A. Coordinate fuse ratings with utilization equipment nameplate limitations of maximum fuse size and with system short-circuit current levels.

1.6 EXTRA MATERIALS

- A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
- B. Fuses: Equal to ten (10) percent of quantity installed for each size and type, but no fewer than three of each size and type.
- C. Fuse Pullers: Two (2) for each size and type.

1.7 WARRANTY

- A. 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.
- B. Special Warranty: Manufacturer's standard form in which manufacturer agrees to replace fuses that fail in materials or workmanship within specified warranty period.
 - 1. Warranty Period: Five years from date of Owner's acceptance.

1.8 PROJECT CONDITIONS

A. A. Where ambient temperature to which fuses are directly exposed is less than 40 deg F or more than 100 deg F, apply manufacturer's ambient temperature adjustment factors to fuse ratings.

PART 2- PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Cooper Bussmann, Inc.
 - 2. Ferraz Shawmut, Inc.
- 2.2 CARTRIDGE FUSES

- A. Characteristics: NEMA FU 1, nonrenewable cartridge fuses with voltage ratings consistent with circuit voltages.
- B. Voltage: Rating suitable for circuit phase-to-phase voltage.

2.3 FUSE APPICATIONS

- B. Circuits 0 to 600 amperes shall be protected by current limiting BUSSMANN LOW-PEAK Dual Element Fuses, LPN-RK (250 volts) or LPS-RK (600 volts). All dual element fuses shall have separate overload and short circuit elements. Fuse shall incorporate a spring activated thermal overload element having a 284NF melting point alloy and shall be independent of the short- circuit clearing chamber. The fuse shall hold 500% of rated current for a minimum of 10 seconds and be listed by Underwriters Laboratories, Inc. with an interrupting rating of 200,000 amperes RMS symmetrical. The fuses shall be UL Class RK1.
- C. Motor Circuits All individual motor circuits rated 480 amperes or less shall be protected by BUSSMANN LOW PEAK DUAL-ELEMENT FUSES LPN-RK (250 volts) or LPS-RK (600 volts). The fuses for 1.15 service factor motors shall be installed in rating approximately 125% of motor full load current except where high ambient temperatures prevail, or where the motor drives a heavy revolving part which cannot be brought up to full speed quickly, such as large fans. Under such conditions the fuse should be 150% to 200% of the Type KRP-C HI-CAP Time Delay Fuses of the rating shown on the drawings. 1.0 service factor motors shall be protected by BUSSMANN LOW-PEAK Dual-Element Fuses LPN RK (250 volts) or LPS-RK (600 volts) installed in rating approximately 115% of the motor full load current except as noted above. The fuses shall be UL Class RK1 or L.
- D. Circuit breaker panels shall be protected by BUSSMANN LOW-PEAK Dual Element fuses LPNRK (250 volts) or LPS-RK (600 volts) as shown on the drawings. The fuses shall be UL Class RK1.

2.4 LIGHTING BALLAST/DRIVER/TRANSFORMER FUSES

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Cooper Bussman, Inc. GLR fuses with HLR holder.
 - 2. Tracor, Inc.; Littelfuse, Inc. Subsidiary LGR fuses with LHR-000 holder.
 - 3. Ferraz Shawmut, Inc. SLR fuses.
- B. Provide each lighting ballast/driver/transformer with individual protection on the line side.
- C. Provide fuse and holder mounted within or as part of the fixture.
- D. Provide fuse size and type recommended by the fixture manufacturer.

2.5 SPARE-FUSE CABINET

- A. Manufacturer: Bussmann #SFC-FUSE-CAB spare fuse cabinet or equal.
- B. Characteristics: Wall-mounted steel unit with full-length, recessed piano-hinged door and key coded cam lock and pull.
- C. Size: Adequate for storage of spare fuses specified with 15 percent spare capacity minimum.

- D. Finish: Gray, baked enamel.
- E. Identification: "SPARE FUSES" in 1-1/2 inch high white letters on black lamicoid plate. Mount plate on exterior of door.
- F. Fuse Pullers: For each size of fuse, where applicable and available, from fuse manufacturer.

PART 3- EXECUTION:

3.1 EXAMINATION

- A. Examine fuses before installation. Reject fuses that are moisture damaged or physically damaged.
- B. Examine holders to receive fuses for compliance with installation tolerances and other conditions affecting performance, such as rejection features.
- C. Examine utilization equipment nameplates and installation instructions. Install fuses of sizes and with characteristics appropriate for each piece of equipment.
- D. Evaluate ambient temperatures to determine if fuse rating adjustment factors must be applied to fuse ratings.
- E. Fuses shall be installed when equipment is ready to be energized, including thorough cleaning and tightening of all electrical connections.
- F. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Fuses shall be shipped separately. Any fuses shipped installed in equipment, shall be replaced by the Electrical Contractor with new fuses as specified above prior to energizing at no additional expense to Owner. All fuses shall be stored in moisture free packaging at job site and shall be installed immediately prior to energizing of the circuit in which it is applied.
- B. No fuses shall be installed in the equipment until the installation is complete, including tests and inspections required prior to being energized. All fuses shall be of the same manufacturer to insure retention of selective coordination, as designed.
- C. Install fuses in fusible devices. Arrange fuses so rating information is readable without removing fuse.
- D. Install spare-fuse cabinet(s). Locate in Main Electrical Room.
- E. Upon completion of the building, the Contractor shall provide the Owner with spare fuses in Spare-Fuse Cabinet.

3.3 IDENTIFICATION

A. Install as part of the lamicoid identification labels indicating fuse rating and type on outside of the door on each fused switch.

END OF 262813

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.

1.2 SUMMARY

- A. Section includes:
 - 1. Fusible Switches
 - 2. Non-Fusible Switches
 - 3. Individually Mounted Circuit Breakers
 - 4. Combination Starter/Disconnect Switches
 - 5. 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. Eaton Electrical Inc.; Cutler-Hammer Business Unit.
 - 3. General Electric Company; GE Consumer & Industrial Electrical Distribution.
 - 4. Siemens
- 2.2 NON-FUSIBLE SWITCHES

- A. All non-fusible safety switches shall be Type HD, Heavy Duty, Single Throw, 600-V ac, 1200 A and Smaller: UL 98 and NEMA KS 1, horsepower rated, lockable handle with capability to accept three padlocks and interlocked with cover in closed position.
- B. All safety switches shall have switch blades that are fully visible in the "OFF" (open) position with the door open.
- C. All safety switches shall have a factory installed ground lug.
- D. All safety switches shall have a factory installed neutral lug, when a neutral is necessary.
- E. All current carrying parts shall be plated by an electrolytic process to resist corrosion and to promote cooling.
- F. Switch mechanism shall be quick-make, quick-break, load break rated, such that during normal operation of the switch, the operation of the contacts shall not be capable of being restrained operating handle after the closing and opening action of the contacts has started. The

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handle and mechanism shall be an integral part of the box (not cover) with facilities for pad locking in the open or closed position with up to three padlocks. Switch doors shall be interlocked with switch handle so that the door can only be opened when the switch is in the "OFF" (open) position.

G. Provide the following Accessories:

1. Equipment Ground Kit: Internally mounted and labeled for copper and aluminum ground conductors.

- 2. Neutral Kit: Internally mounted; insulated, capable of being grounded and bonded; labeled for copper and aluminum neutral conductors.
- 3. Lugs: Mechanical type, suitable for number, size, and conductor material.

2.3 FUSIBLE SWITCHES

- A. All fusible safety switches shall be Type HD, Heavy Duty, Single Throw, 600-V ac, 1200 A and Smaller: UL 98 and NEMA KS 1, horsepower rated, lockable handle with capability to accept three padlocks and interlocked with cover in closed position.
- B. All safety switches shall have switch blades that are fully visible in the "OFF" (open) position with the door open.
- C. All safety switches shall have a factory installed ground lug.
- D. All safety switches shall have a factory installed neutral lug, when a neutral is required.
- E. All current carrying parts shall be plated by an electrolytic process to resist corrosion and to promote cooling.
- F. Switch mechanism shall be quick-make, quick-break, load break rated, such that during normal operation of the switch, the operation of the contacts shall not be capable of being restrained

operating handle after the closing and opening action of the contacts has started. The handle and mechanism shall be an integral part of the box (not cover) with facilities for pad locking in the open or closed position with up to three padlocks. Switch doors shall be interlocked with switch handle so that the door can only be opened when the switch is in the by the

G. Provide the following Accessories:

"OFF" (open) position.

1. Equipment Ground Kit: Internally mounted and labeled for copper and aluminum ground conductors.

- 2. Neutral Kit: Internally mounted; insulated, capable of being grounded and bonded; labeled for copper and aluminum neutral conductors.
- 3. Class R Fuse Kit: Provides rejection of other fuse types when Class R fuses are specified.
- 4. Lugs: Mechanical type, suitable for number, size, and conductor material.

2.4 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.

2.5 COMBINATION STARTER/DISCONNECT SWITCHES

- A. All combination starter/disconnect switches shall be full-voltage, non-reversing type.
- B. All combination starter/disconnect switches shall have low-voltage protection, solid state overloads, Hands-Off-Auto selector switch and Red and Green pilot lights.
- C. All combination starter/disconnect switches shall be Type HD, Heavy Duty, Single Throw, 600-V ac, 1200 A and Smaller: UL 98 and NEMA KS 1, horsepower rated, lockable handle with capability to accept three padlocks, and interlocked with cover in closed position.
- D. Combination motor starters shall be rated in accordance with NEMA sizes and horsepower ratings. No starter shall be listed as a fractional size.
- E. Contactor contacts shall be silver alloy, double break, and shall allow for inspection on NEMA Sizes 00 through 4 without the use of tools. Size 5 and larger shall allow for inspection utilizing standard tools. They shall be replaceable without removing the line, load, or control wiring from the starter, and replaceable without removing the starter from the enclosure.
- F. Contactor coils shall be the encapsulated type, and shall be replaceable on NEMA Sizes 00
through 4 without the use of tools. Size 5 and larger shall be replaceable with standard tools. They shall be replaceable without removing the line, load, or control wiring from the starter, and replaceable without removing the starter from the enclosure.

- G. Overload protection shall be provided by solid state electronic overload relay. Single-phase starters shall provide one- or two-leg overload protection; three-phase starters shall provide three-leg overload protection.
- H. Combination starter shall be suitable for straight through wiring.
- I. Switch mechanism shall be quick-make, quick-break, load break rated, such that during normal operation of the switch, the operation of the contacts shall not be capable of being restrained operating handle after the closing and opening action of the contacts has started. The

by the

handle and mechanism shall be an integral part of the box (not cover) with facilities for pad locking in the open or closed position with up to three padlocks. Switch doors shall be interlocked with switch handle so that the door can only be opened when the switch is in the "OFF" (open) position.

- J. All safety switches shall have a factory installed ground lug.
- K. All safety switches shall have a factory installed neutral lug, when a neutral is necessary.
- L. All current carrying parts shall be plated by an electrolytic process to resist corrosion and to promote cooling.
- M. Provide the following Accessories:

1. Equipment Ground Kit: Internally mounted and labeled for copper and aluminum ground conductors.

- 2. Neutral Kit: Internally mounted; insulated, capable of being grounded and bonded; labeled for copper and aluminum neutral conductors.
- 3. Lugs: Mechanical type, suitable for number, size, and conductor material.

2.6 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. Install fuses in fusible devices.
- C. 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 262816

264300- SURGE PROTECTION FOR LOW-VOLTAGE ELECTRICAL POWER CIRCUITS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General, 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.

1.2 SUMMARY

- A. Section includes field-mounted SPDs for low-voltage (120 to 600 V) power distribution and control equipment.
- B. The Contractor shall provide the necessary labor, materials, wiring and services necessary to provide the complete electrical surge protection systems as specified herein. This work shall include, but is not necessarily limited to:
- C. Provision of Surge Suppression Units at certain points in the power distribution network and on telephone and television service lines.
- D. Proper installation of surge suppression unit(s), in accord with shop drawings. Wiring routing, grounding and all connections shall be in exact accord with manufacturer's recommendations.

1.3 DEFINITIONS

- A. MCOV: Maximum continuous operating voltage.
- B. Mode(s), also Modes of Protection: The pair of electrical connections where the VPR applies.
- C. MOV: Metal-oxide varistor; an electronic component with a significant non-ohmic current voltage characteristic.
- D. OCPD: Overcurrent protective device.
- E. SCCR: Short-circuit current rating.
- F. SPD: Surge protective device.
- G. VPR: Voltage protection rating.
- 1.4 SUBMITTALS
 - A. Product Data: Submit manufacturer's data, for each type of product, on surge protection systems and components as part of shop drawing submissions. Indicate all capacity ratings, clamp times, maximum capacities, physical construction and listing agency approvals. Submittals shall include UL 1449, 3rd Edition Listing documentation verifying:
 - 1. Copy of UL Category Code VZCA certification, as a minimum, listing the tested values for VPRs, I-nominal ratings, MCOVs, type designations, OCPD requirements, model numbers, system voltages, and modes of protection.

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- 2. Short Circuit Current Rating (SCCR).
- 3. Voltage Protection Ratings (VPRs) for all modes.
- 4. Maximum Continuous Operating Voltage rating (MCOV). The MCOV shall be a tested value per UL1449 3rd Edition, section 37.7.3. MCOV values bases solely on the components used in the construction of the SPD will not be accepted.
- 5. I-nominal rating (I-n).
- 6. Type 1 or Type 2 Device Listing.
- 7. Manufacturer shall provide written test report showing the SPD can survive a single surge at its rated value without the use of circuit breakers or fuses.
- 8. kA rating per phase.
- 9. kA rating per mode.
- B. Submittals shall also include the following:
 - 1. Line drawings detailing dimensions and weight of enclosure.
 - 2. Listing and rating of all modes of protection in each type of SPD required.
 - 3. Breaker sizes used for SPD service disconnects.
 - 4. Wiring diagram showing all manufacturer installed wiring including wire size, type, routing, and exact length of conductors.
 - 5. Listing of equipment where each type of SPD is installed.
- C. Maintenance Data: Submit maintenance instructions for surge suppression system. Include this data in Operation and Maintenance manuals.
- 1.5 QUALITY ASSURANCE
 - A. STANDARDS Most Recent Edition of
 - 1. Underwriters Laboratories: UL1449, 3RD Edition
 - 2. ANSI/IEEE C62.41.1-2002, C62.41.2-2002, C62.45-2002
 - 3. National Electrical Code: Article 285
 - B. Manufacturer shall be regularly engaged in production of surge protection equipment of types, sizes and ratings required, whose products have been satisfactorily used in similar service for not less than three years.
 - C. LISTING REQUIRMENTS: Comply with NEC and NFPA requirements, as applicable to materials and installation of surge protection components and wiring. Surge protection equipment shall be UL listed and labeled for its intended use. "Manufactured in accordance with" is not equivalent to UL listing and does not meet the intent of this specification. Where applicable, equipment shall comply with ANSI standards for such equipment. All equipment shall be tested per IEEE testing standards listed in this section.
 - D. SPECIAL NOTE: The physical routing, length, and connections of the unit's phase, neutral and ground conductors are critical to the performance of surge suppression units. All wiring shall be installed by the manufacturer prior to shipping equipment and shall not exceed three feet of length.

1.6 WARRANTY

- A. Manufacturer's Warranty: Manufacturer agrees to replace or replace SPDs that fail in materials or workmanship within specified warranty period.
 - 1. Warranty Period: All surge suppression equipment shall be unconditionally warranted by the Contractor for a period of ten (10) years from the date of substantial completion.

If longer manufacturer's warranties are offered, they shall be made available to the Owner.

- Note these extended warranties in the Operations and Maintenance Manuals.
- B. 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.
- 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 MANUFACTURERS

- A. MANUFACTURERS: Subject to compliance with requirements, provide products by one of the following:
 - 1. Eaton Electrical Inc.; Cutler-Hammer Business Unit.
 - 2. General Electric Company; GE Consumer & Industrial Electrical Distribution.
 - 3. Square D; a brand of Schneider Electric.
 - 4. Siemens

2.2 GENERAL SPD REQUIREMENTS

- A. Provide UL listed and labeled lightning and transient surge protection devices (SPD's), installed where shown on the drawings and in accord with the manufacturer's recommendations. The surge protection devices shall be shunt type and poly-phase, with the ability to conduct high energy transients from line to neutral and neutral to ground.
- B. Surge Protection Device Description: IEEE C62.41-compliant, integrally mounted, wired-in bolton, solidstate, parallel-connected, modular (with field-replaceable modules) type, with sinewave tracking suppression and filtering modules, UL 1449, second edition, short-circuit current rating matching or exceeding the switchgear short-circuit rating.
- C. SPD shall be UL labeled with 200kA Short Circuit Current Rating (SCCR). Fuse ratings shall not be considered in lieu of demonstrated withstand testing of SPD, per NEC 285.6.
- D. Internal Device Overcurrent Protection (Fusing): All protection modes (including Neutral to Ground) of each surge suppression device shall be internally fused at the component level with fuse I21 capability allowing the suppressor's maximum rated transient current to pass through the suppressor without fuse operation. If the rated I2T characteristic of the fusing is exceeded, the fusing shall be capable of opening in less than one millisecond and clear both high and low impedance fault conditions. The fusing shall be capable of interrupting up to 200kA symmetrical fault current with 600 VAC applied. This overcurrent protection circuit shall be monitored, to provide indication of suppression failure. Conductor level fuses or circuit breakers internal or external to the surge suppression units are not acceptable as meeting this requirement.
- E. SPD shall be UL labeled as Type 1 or Type 2, intended for use without need for external or supplemental overcurrent controls. Every suppression component of every mode, including NG, shall be protected by internal overcurrent and thermal over-temperature controls.

- F. Each MOV shall be individually fuse-protected to avoid cascading faults. This shall be certified by Manufacturers letter of compliance.
- G. SPD shall be UL labeled with 20kA nominal (I-n) (verifiable at UL.com) for compliance with UL 96A Lightning Protection Master Label and NFPA 780.
- H. SPD shall provide surge current paths for all modes of protection: L-N, L-G, and N-G for Wye systems; L-L, L-G in Delta and impedance grounded Wye systems.

I.	UL 1449, 3rd Edition Listed	Voltage Protection	Ratings (VPRs)	shall not exceed the	e following:
	System Voltage	L-N	L-G	L-L	N-G
	208Y/120	700V	700V	1200V	700V

Note: Numerically lower values are allowed/preferred; out-dated Suppressed Voltage Ratings (SVRs) shall not be submitted.

J.	UL 1449, 3rd Edition Listed Maximum Continuous Operating Voltage (MCOV):				
	System Voltage	Allowable System Voltage	Fluctuation (%)	MCOV	
	208Y/120	25%	150V		

- K. SPD shall be installed integral to switchgear, panels, etc. where possible. SPD's shall be installed in new equipment at the factory and complete, furnished assemblies shall be UL listed.
- L. For each SPD, provide unit function status indicators. These indicators shall be mounted in the face of the equipment panel. Provide minimum one green LED per phase illuminated for normal operation, red L.E.D. for trouble/fault or reduction of surge suppression capacity.
- M. Proposed substitutions for the manufacturer's model numbers listed here shall meet or exceed the current published performance data for the units listed, and shall be submitted to the Engineer ten working days prior to bid for review.
- N. SPD with Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

2.4 PANELBOARD AND DISTRIBUTION PANELBOARD SURGE SUPPRESSORS

- A. Branch and distribution panelboard units shall be installed as indicated on the contract documents and shall be 240kA per phase, heavy duty type. All units shall be 3 phase, 4 wire and shall have the following surge current capability (single pulse rated): Line to Neutral 240,000 amperes; Line to Ground 240,000 amperes; Line to Line 240,000 amperes; and Neutral to Ground 240,000 amperes. All MOV's shall be individually fused.
- B. Provide 60A circuit breaker in panel being protected for unit disconnecting means. Utilize #6 AWG wire for connection to panelboard. Maximum wire length is three feet.
- C. SPDs: Comply with UL 1449, Type 2.
 - 1. Include LED indicator lights for power and protection status.
 - 2. Internal thermal protection that disconnects the SPD before damaging internal suppressor components.
- D. Peak Surge Current Rating: The minimum single-pulse surge current withstand rating per phase shall not be less than 100 kA. The peak surge current rating shall be the arithmetic sum of the ratings of the individual MOVs in a given mode.

- E. Comply with UL 1283.
- F. Protection modes and UL 1449 VPR for grounded wye circuits with 480Y/277 V or 208Y/120 V, three-phase, four-wire circuits shall not exceed the following:
 - 1. Line to Neutral: 700 V for 208Y/120 V
 - 2. Line to Ground: 700 V for 208Y/120 V
 - 3. Neutral to Ground: 700 V for 208Y/120 V
 - 4. Line to Line: 1200 V for 208Y/120 V
 - G. SCCR: Equal or exceed 100 kA.
 - H. Incominal Rating: 10 kA.

2.5 TELEPHONE AND TELEVISION SURGE SUPPRESSION

- A. As a part of this section of work, the Contractor shall provide U.L. listed lightning and surge arrestors on the incoming telephone, video, and television service lines.
- B. Arrestors shall be U.L. listed, properly grounded per N.E.C., and shall be located at the service entrance points for each cable. Also provide surge arrestors of the proper type for copper cables that are installed between buildings by the Contractor.
- C. Arrestors for telephone lines shall be RJ-45 in/out, complete with RJ-45 jumpers as needed. Provide quantity as required, connecting one to each phone line. Provide two spare units to Owner for future use.
- D. Arrestors for coaxial lines shall be 25 to 250 MHZ on cable T.V. lines (with BNC jacks in/out or as required by antenna connectors).
- E. Provide a ground lug for individual surge suppression unit installations, with the recommended ground wire size routed back to the building main electrical ground.
- F. Where multiple surge suppression units are installed, as at service entrance locations, provide a ground bar, copper with multiple tapped holes and a properly sized ground lead routed back to the building main electrical ground.
- 2.6 ENCLOSURES
 - A. Indoor Enclosures: NEMA 250, Type 1.

2.7 CONDUCTORS AND CABLES

A. Power Wiring: Same size as SPD leads, complying with Section 16140.

PART 3- EXECUTION

- 3.1 INSTALLATION
 - A. Comply with NECA 1.
 - B. Install an OCPD or disconnect as required to comply with the UL listing of the SPD.
 - C. Install SPDs as indicated and in accordance with equipment manufacturer's written instructions, in compliance with applicable requirements of NFPA, local prevailing codes and with UL lightning and power surge protection standards to ensure that surge suppression systems comply with requirements.

- D. Install SPDs with conductors between suppressor and points of attachment as short and straight as possible, and adjust circuit-breaker positions to achieve shortest and straightest leads. Do not splice and extend SPD leads unless specifically permitted by manufacturer. Do not exceed manufacturer's recommended lead length. Do not bond neutral and ground.
- E. Use crimped connectors and splices only. Wire nuts are unacceptable.
- F. Wiring: Power Wiring: Comply with wiring methods in Section 16140.
- 3.2 FIELD QUALITY CONTROL
 - A. Perform the following tests and inspections:
 - 1. Compare equipment nameplate data for compliance with Drawings and Specifications.
 - 2. Inspect anchorage, alignment, grounding, and clearances.
 - 3. Verify that electrical wiring installation complies with manufacturer's written installation requirements.
 - B. An SPD will be considered defective if it does not pass tests and inspections.
 - C. Prepare test and inspection reports.
- 3.3 STARTUP SERVICE
 - A. Complete startup checks according to manufacturer's written instructions.
 - B. Do not perform insulation-resistance tests of the distribution wiring equipment with SPDs installed. Disconnect SPDs before conducting insulation-resistance tests, and reconnect them immediately after the testing is over.
 - C. Energize SPDs after power system has been energized, stabilized, and tested.
- 3.4 DEMONSTRATION
 - A. Train Owner's maintenance personnel to operate and maintain SPDs.

END OF 264300

SECTION 265100 - INTERIOR LIGHTING

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Interior lighting fixtures, lamps.
 - 2. Emergency lighting units.
 - 3. Exit signs.
 - 4. Lighting fixture supports.

B. Related Sections:

- 1. Division 26 Section "Lighting Control Devices" for automatic control of lighting, including time switches, photoelectric relays, occupancy sensors, and multipole lighting relays and contactors.
- 2. Division 26 Section "Wiring Devices" for manual wall-box dimmers for incandescent lamps.

1.2 SUBMITTALS

- A. Product Data: For each type of lighting fixture, arranged in order of fixture designation. Include data on features, accessories, and finishes.
- B. Shop Drawings: Show details of nonstandard or custom lighting fixtures. Indicate dimensions, weights, methods of field assembly, components, features, and accessories. Product Certificates: For each type of ballast for bi-level and dimmer-controlled fixtures, from manufacturer.
- C. Field quality-control reports.

1.3 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 NFPA 70.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, product(s) indicated on Drawings. Substitutions shall be submitted to Engineer minimum (10) days prior to bid date for evaluation.

2.2 LIGHTING FIXTURE SUPPORT COMPONENTS

- A. Comply with Division 26 Section "Hangers and Supports for Electrical Systems" for channeland angle-iron supports and nonmetallic channel and angle supports.
- B. Single-Stem Hangers: 1/2-inch steel tubing with swivel ball fittings and ceiling canopy. Finish same as fixture.
- C. Twin-Stem Hangers: Two, 1/2-inch steel tubes with single canopy designed to mount a single fixture. Finish same as fixture.
- D. Wires: ASTM A 641/A 641M, Class 3, soft temper, zinc-coated steel, 12 gage.
- E. Wires for Humid Spaces: ASTM A 580/A 580M, Composition 302 or 304, annealed stainless steel, 12 gage.
- F. Rod Hangers: 3/16-inch minimum diameter, cadmium-plated, threaded steel rod.
- G. Hook Hangers: Integrated assembly matched to fixture and line voltage and equipped with threaded attachment, cord, and locking-type plug.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Lighting fixtures: Set level, plumb, and square with ceilings and walls. Install lamps in each fixture.
- B. Comply with NFPA 70 for minimum fixture supports.
- C. Suspended Lighting Fixture Support:
 - 1. Pendants and Rods: Where longer than 48 inches brace to limit swinging.
 - 2. Stem-Mounted, Single-Unit Fixtures: Suspend with twin-stem hangers.
 - 3. Continuous Rows: Use tubing or stem for wiring at one point and tubing or rod for suspension for each unit length of fixture chassis, including one at each end.
- D. Adjust aimable lighting fixtures to provide required light intensities.

E. Connect wiring according to Division 26 Section "Low-Voltage Electrical Power Conductors and Cables."

3.2 FIELD QUALITY CONTROL

- A. Test for Emergency Lighting: Interrupt power supply to demonstrate proper operation. Verify transfer from normal power to battery and retransfer to normal.
- B. Prepare a written report of tests, inspections, observations, and verifications indicating and interpreting results. If adjustments are made to lighting system, retest to demonstrate compliance with standards.

END OF SECTION 265100

SECTION 265600 - EXTERIOR LIGHTING

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Exterior luminaires with lamps.

1.2 SUBMITTALS

- A. Product Data: For each luminaire, pole, and support component, arranged in order of lighting unit designation. Include data on features, accessories, and finishes.
- B. Shop Drawings: Anchor-bolt templates keyed to specific poles and certified by manufacturer.

1.3 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 IEEE C2, "National Electrical Safety Code."
- C. Comply with NFPA 70.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, product(s) indicated on Drawings. Substitutions shall be submitted to Engineer minimum (10) days prior to bid date for evaluation.

PART 3 - EXECUTION

- 3.1 LUMINAIRE INSTALLATION
 - A. Install lamps in each luminaire.
 - B. Fasten luminaire to indicated structural supports.

- 1. Use fastening methods and materials selected to resist seismic forces defined for the application and approved by manufacturer.
- C. Adjust luminaires that require field adjustment or aiming.

3.2 CORROSION PREVENTION

- A. Aluminum: Do not use in contact with earth or concrete. When in direct contact with a dissimilar metal, protect aluminum by insulating fittings or treatment.
- B. Steel Conduits: Comply with Division 26 Section "Raceway and Boxes for Electrical Systems." In concrete foundations, wrap conduit with 0.010-inch-thick, pipe-wrapping plastic tape applied with a 50 percent overlap.

3.3 GROUNDING

- A. Ground metal poles and support structures according to Division 26 Section "Grounding and Bonding for Electrical Systems."
 - 1. Install grounding electrode for each pole unless otherwise indicated.
 - 2. Install grounding conductor pigtail in the base for connecting luminaire to grounding system.
- B. Ground nonmetallic poles and support structures according to Division 26 Section "Grounding and Bonding for Electrical Systems."
 - 1. Install grounding electrode for each pole.
 - 2. Install grounding conductor and conductor protector.
 - 3. Ground metallic components of pole accessories and foundations.

END OF SECTION 265600

DIVISION 27 DATA AND COMMUNICATIONS

TELECOM/DATA AND CABLE T.V. ENTRANCE RACEWAY SYSTEM - 27100

PART 1 - GENERAL

1.1 SCOPE OF THE WORK

- A single-gang box and a 3/4" conduit routed, from the locations of each telecom/data, cable T.V. and security device outlet box, to an accessible location above a drop-ceiling in the corridors.
- (2) Two (2) 3" conduits from the two (2) termination boards at the main telecom demark (demarcation point) to the Service location for fiber service wiring. Provide pull-string in these conduits for the various service company's use.
- (3) One (1) 3" conduit from the main telecom backboard (demarcation point) to the Cable T.V. Service for cable T.V. service wiring. Provide pull-string in these conduits for the cable T.V. company's use.
- (4) Three (2) 4'x8'x3/4", fire-rated, plywood telecom backboard in each telecom equipment room. These backboards are to be provided for the installation of any telecom/data and/or cable T.V. equipment. Provide (3) fiber termination boards in the demark room.

PART 2 - PRODUCTS

CONDUIT REQUIREMENTS

2.1 METAL CONDUIT

- A. Manufacturers: Subject to compliance with project requirements, manufacturers offering specified items which may be incorporated in the Work include the following:
 - 1. Allied Tube & Conduit, Harvey, IL (800) 882-5543.
 - 2. Wheatland Tube Co., Collinswood, NJ (800) 257-8182.
 - 3. Republic Wire & Cable, Rocky Mount, NC (800) 533-8198.
 - 4. Section 016000 Product Requirements: Product options and substitutions. Substitutions: Permitted.
- B. Rigid Galvanized Steel Conduit (GRC): ANSI C80.1, UL6.
- C. Intermediate Metal Conduit (IMC): UL1242.
- D. Fittings and Conduit Bodies: NEMA FB1 Material to match conduit.

DIVISION 27 DATA AND COMMUNICATIONS

2.2 ELECTRICAL METALLIC TUBING (EMT)

- A. Manufacturers: Subject to compliance with project requirements, manufacturers offering specified items which may be incorporated in the Work include the following:
 - 1. Allied Tube & Conduit, Harvey, IL (800) 882-5543.
 - 2. Wheatland Tube Co., Collinswood, NJ (800) 257-8182.
 - 3. Republic Wire & Cable, Rocky Mount, NC (800) 533-8198.
 - 4. Section 016000 Product Requirements: Product options and substitutions. Substitutions: Permitted.
- B. Description: ANSI C80.3; galvanized tubing.
- C. Fittings and Conduit Bodies: NEMA FB 1; steel set-screw type. Die-cut Zinc not permitted.

2.3 OUTLET BOXES

- A. Sheet Metal Outlet Boxes: NEMA OS 1, galvanized steel.
 - 1. Luminaire and Equipment Supporting Boxes: Rated for weight of equipment supported; include 1/2 inch male fixture studs where required.
 - 2. Receptacle and Device Boxes 4 inch square x 2-1/8 inch deep with raised, single gang, plaster ring unless indicated otherwise.
 - 3. Switch Boxes: 2 inch x 4 inch x 2-1/8 inch deep, unless indicated otherwise.
 - 4. Communication Boxes: 4 inch square x 3 inch deep with raised gang plaster ring unless indicated otherwise.
- B. Cast Boxes: NEMA FB 1, Type FD, aluminum. Provide gasketed cover by box manufacturer. Provide threaded hubs.
- C. Wall Plates for Finished Areas: Specified in Section 262726.

2.4 FLOOR BOXES

- A. Type: Modular, flush-type dual-service units suitable for wiring method used. Provide dualservice units within carpeted areas only.
- B. Compartmentation: Barrier separates power and signal compartments.
- C. Housing Material: Die-cast aluminum, satin-finished.
- D. Power Receptacle: NEMA WD 6, Configuration 5-20R, ivory finish, unless otherwise indicated.
- E. Signal Outlet: Blank cover with brushed cable opening, unless otherwise indicated.

DIVISION 27 DATA AND COMMUNICATIONS

PART 3 - INSTALLATION

- 3.1 No more than the equivalent of two 90 degree sweeps will be allowed in a run, including offsets. All 90-degree bends are to be long sweep bends.
- 3.2 A pull wire shall be installed and tied off in each empty conduit. Pull wires used outside of facilities shall be stainless steel or copper, #12 AWG. Pull wires used inside facilities shall be nylon.
- 3.3 All communications conduits shall be a minimum of 12" from power conduits or cables. All communications conduits shall also be a minimum of 24" from steam pipes and condensation lines if crossing perpendicular.
- 3.4 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.
- 3.5 All conduit, tubing, and raceways shall be installed in such a manner to insure against collection of trapped condensation. Raceway runs shall be arranged to be void of traps.
- 3.6 Provide nylon pull-strings and blank faceplates for all empty telephone/data outlet boxes and building security system boxes.

END OF SECTION

FIRE ALARM SYSTEM – SECTION 283116

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.
- B. Related Sections:
 - 1. Division 01 General Requirements
 - 2. Division 07 Thermal and Moisture Protection, Section 078413 Penetration Firestopping
 - 3. Division 08 Openings, Section 087100 Door Hardware
 - 4. Division 21 Fire Suppression
 - 5. Division 23 Heating Ventilating and Air Conditioning Monitoring & Control (HVAC).
 - 6. Division 26 Electrical, Section 260500 Common Work Results for Electrical

1.02 SUMMARY

- A. Section Includes:
 - 1. This specification describes an addressable Fire Detection and alarm signaling system. The control panel shall be intelligent device addressable, analog detecting, low voltage and modular, with digital communication techniques, in full compliance with all applicable codes and standards. The features and capacities described in this specification are required as a minimum for this project and shall be furnished by the successful contractor.
 - 2. The system shall be in full compliance with National and Local Codes.
 - 3. The system shall include all required hardware, raceways, interconnecting wiring and software to accomplish the requirements of this specification and the contract drawings, whether or not specifically itemized herein.
 - 4. All equipment furnished shall be new and the latest state-of-the-art products of a single manufacturer, engaged in the manufacturing and sale of analog fire detection devices for over ten years.
 - 5. The system as specified shall be supplied, installed, tested and approved by the local Authority Having Jurisdiction, and turned over to the owner in an operational condition.
 - 6. In the interest of job coordination and responsibilities, the installing contractor shall contract with a single supplier for fire alarm equipment, engineering, programming,

inspection and tests, and shall be capable of providing a "UL Listing Certificate" for the complete system.

7. The system specified shall be that of Siemens Desigo[™] Fire Safety, Simplex, or Honeywell which meets the project requirements. Other systems shall be submitted 10 days prior to bid date for approval by the Engineer. All system approved shall meet all the requirements spelled out in this specification. System approval shall be in writing by the Engineer and a copy shall be submitted with the system submittals. Siemens factory direct office shall perform the work on this project. Substituted systems (subject to Engineer approval) shall also be provided by factory direct office of said system - no "3rd party" alternative products will be considered.

1.03 DEFINITIONS

- A. ASME: American Society of Mechanical Engineers.
- B. FACP: Fire alarm control panel.
- C. FM: FM Global (Factory Mutual).
- D. Furnish: To supply the stated equipment or materials.
- E. Install: To set in position and connect or adjust for use.
- F. LED: Light-emitting diode.
- G. NCC: Network Command Center.
- H. NFPA: National Fire Protection Association. Definitions in NFPA 72 apply to fire alarm terms used in this Section.
- I. NICET: National Institute for Certification in Engineering Technologies.
- J. Provide: To furnish and install the stated equipment or materials.
- K. UL: Underwriters Laboratories.

1.04 SYSTEM DESCRIPTION

- A. The system shall be a complete, electrically supervised fire detection and notification system, with a microprocessor based operating system having the following capabilities, features, and capacities:
 - 1. The local system shall provide status indicators and control switches for all of the following functions:
 - a. Audible and visual notification alarm circuit zone control.
 - b. Status indicators for sprinkler system water-flow and valve supervisory devices.

c. Any additional status or control functions as indicated on the drawings, including but not limited to; emergency generator functions, fire pump functions, door unlocking and security with bypass capabilities.

1.05 PERFORMANCE REQUIREMENTS

- A. General Performance: Comply with NFPA 72 and all contract documents and specification requirements.
- B. All interconnections between this system and the monitoring system shall be arranged so that the entire system can be UL-Certificated.
- C. System shall be a complete, supervised, non-coded, addressable multiplex fire alarm system conforming to NFPA 72.
- D. The system shall have Style 4 circuits for each floor. The system shall operate in the alarm mode upon actuation of any alarm initiating device. The system shall remain in the alarm mode until all initiating device(s) are reset and the fire alarm control panel is manually reset and restored to normal.
- E. The system shall be capable of the following configurations. Both configurations are permitted on the same network.
 - 1. The system shall support up to 252 addressable devices, which may be divided in any ratio on one, two, three, or four separate, isolated Class B circuits.
 - 2. The system shall support two loops of 252 addressable devices, each of which may be divided in any ratio on one, two, three, or four separate, isolated Class B circuits.
- F. The system shall support H-series devices and Desigo[™] Fire Safety series devices.
- G. The system shall have an optional digital alarm communication transmitter.
- H. The system shall provide an off-normal warning prior to reset for all active devices.
- I. The system shall be capable of remote monitoring via DesigoTM View®, a proprietary software system that provides a graphical representation of the fire alarm control panel at a remote PC when connected via Ethernet to the system. The display will show the exact state of the panel, including blinking LEDs, and with menu buttons for control.
- J. The system shall be capable of being configured via a PC Tool.
- K. The system shall provide the following functions and operating features:
 - 1. The FACP and auxiliary power panels shall provide power, annunciation, supervision and control for the system.
 - 2. Provide Class B initiating device circuits.

- 3. Provide two Class B notification appliance circuits. Arrange circuits to allow individual, selective, and visual notification by zone. Notification appliance circuits shall be zoned to correspond with the building fire barriers and other building features.
- 4. Strobes shall be synchronized throughout the entire building.
- 5. Provide electrical supervision of the primary power (AC) supply, presence of the battery, battery voltage, and placement of system modules within the control panel.
- L. The system shall provide a field test function where one person can test the complete system or a specific area while maintaining full operational function of other areas not being tested. Alarms, supervisory signals, trouble signals shall be logged in system history during the walktest.
- M. Alarm functions shall override trouble or supervisory functions. Supervisory functions shall override trouble functions.
- N. Fire alarm signal initiation shall be by one or more of the following devices:
 - 1. Manual pull station
 - 2. Heat detector
 - 3. Addressable area smoke detectors
 - 4. Addressable area smokes detectors with audible low frequency sounder bases for resident rooms areas in NFPA compliance
 - 5. Standard Addressable Duct smoke detector
 - 6. Specialized Duct Smoke detector
 - 7. Automatic sprinkler system water flow switch.
- O. Activation of any system fire, security, supervisory, trouble, or status initiating device shall cause the following actions and indications at all network Person Machine Interfaces using an LCD display with multiple detail screens.
 - 1. Fire Alarm Condition:
 - a. Sound an audible alarm and display a custom message defining the building in alarm and the specific alarm point initiating the alarm on an LCD display.
 - b. Log into the system history archives all activity pertaining to the alarm condition.
 - c. Sound the ANSI 117-1 signal with synchronized audible notification appliances and synchronized strobes throughout the facility.

- d. Audible signals shall be silenced from the fire alarm control panel by an alarm silence switch. Visual signals shall be programmable to flash until system reset or alarm silencing, as required.
- e. A signal dedicated to sprinkler system water flow alarm shall not be silenced while the sprinkler system is flowing at a rate of flow equal to a single head.
- f. Activation of any smoke detector in a single elevator lobby or an elevator equipment room shall, in addition to the actions described, cause the recall of that bank of elevators to the 1st floor and the lockout of controls. In the event of recall initiation by a detector in the first floor lobby, the recall shall be to the alternate floor as determined by the AHJ.
- g. Where indicated on drawings heat detectors in elevator shaft and machine rooms shall activate an elevator power shunt trip breaker. The heat detectors shall be rated at a temperature below the ratings of the sprinkler heads in respective locations to insure that the power shall be shut off before activation of sprinkler system.
- h. System operated duct detectors as per local requirements shall accomplish HVAC shut down.
- i. Door closure devices shall operate by floor or by local requirements.
- 2. Supervisory Condition:
 - a. Display the origin of the supervisory condition report at the local fire alarm control panel LCD display.
 - b. Activate supervisory audible and dedicated visual signal.
 - c. Audible signals shall be silenced from the control panel by the supervisory acknowledge switch.
 - d. Record within system history the initiating device and time of occurrence of the event.
- 3. Trouble Condition
 - a. Display at the local fire alarm control panel LCD display, the origin of the trouble condition report.
 - b. Activate trouble audible and visual signals at the control panel and as indicated on the drawings.
 - c. Audible signals shall be silenced from the fire alarm control panel by a trouble acknowledge switch.
 - d. Trouble conditions that have been restored to normal shall be automatically removed from the trouble display queue and not require operator intervention. This feature

shall be software selectable and shall not preclude the logging of trouble events to the historical file.

- e. Trouble reports for primary system power failure to the master control shall be automatically delayed for a period of time equal to 25% of the system standby battery capacity to eliminate spurious reports as a result of power fluctuations.
- f. Record within system history, the occurrence of the event, the time of occurrence and the device initiating the event.
- P. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes.

1.06 SUBMITTALS

- A. Fire alarm supplier shall prepare plans, specs., & shop drawings to meet required life safety codes & submit to authority having jurisdiction for approval before beginning any rough-in work of the fire alarm system.
- B. Fire alarm supplier shall submit with CADD file "approved" fire alarm submittal, along indicating locations & wiring connections to all components of the system, including sprinkler riser monitoring devices. Fire alarm vendor shall provide certification of the completed, installed system by a "certified fire alarm inspector" licensed by the commonwealth of Kentucky.
- C. Product data: for each type of product indicated. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes. Include rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories. Complete manufacturer's catalog data including supervisory power usage, alarm power usage, physical dimensions, and finish and mounting requirements.
- D. Power calculations. Battery capacity calculations. Battery size shall be a minimum of 125% of the calculated requirement. Provide the following supporting information:
 - 1. Supervisory power requirements for all equipment.
 - 2. Alarm power requirements for all equipment.
 - 3. Power supply rating justification showing power requirements for each of the system power supplies. Power supplies shall be sized to furnish the total connected load in a worst-case condition plus 25% spare capacity.
 - 4. Voltage drop calculations for wiring runs demonstrating worst-case condition.
 - 5. NAC circuit design shall incorporate a 15% spare capacity for future expansion.
- E. Submit manufacturer's requirements for testing Signaling Line Circuits and device addresses prior to connecting to control panel. At a minimum the following tests shall be required; device address, the usage (Alarm, Supervisory etc), environmental compensation, temperature

ratings for thermal detectors and smoke detector sensitivities. This requirement shall need approval before any wiring is connected to the control panel.

- F. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.
 - 1. Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
 - 2. Wiring Diagrams: For power, signal, and control wiring.
 - 3. Complete drawings covering the following shall be submitted by the contractor for the proposed system:
 - a. Floor plans in a CAD compatible format at a scale of 1/8"=1'-0" showing all equipment and raceways, marked for size, conductor count with type and size, showing the percentage of allowable National Electric Code fill used.
 - b. Provide a fire alarm system function matrix as referenced by NFPA 72, Figure A-7-5.2.2 (9). Matrix shall illustrate alarm input/out events in association with initiation devices. Matrix summary shall include system supervisory and trouble output functions. Include any and all departures, exceptions, variances or substitutions from these specifications and/or drawings at time of bid.
 - 4. Installation drawings shop drawings, and as-built drawings shall be prepared by an individual experienced with the work specified herein.
 - 5. Incomplete submittals shall be returned without review, unless with prior approval of the Engineer.
- G. Coordination Drawings: Reflected ceiling plan(s) and other details, drawn to scale, on which the following items are shown and coordinated with each other, using input from Installers of the items involved:
 - 1. Light fixtures.
 - 2. HVAC registers
 - 3. Fire protection equipment interfaces
 - 4. Special suppression system interfaces
- H. Qualification Data: For qualified Installer, Applicator, manufacturer, fabricator, professional engineer, testing agency, and factory-authorized service representative.
- I. Source quality-control reports.
- J. Field quality-control reports.

- K. Operation and Maintenance Data: For all fire alarm equipment, to include in operation and maintenance manuals.
- L. Software and Firmware Operational Documentation:
 - 1. Software operating and upgrade manuals.
 - 2. Program Software Backup: On magnetic media or compact disk, complete with data files.
 - 3. Device address list.
 - 4. Printout of software application and graphic screens.
- M. Warranty: Sample of special warranty.

1.07 QUALITY ASSURANCE

- A. Manufacturer Qualifications: The publications listed below form a part of this publication to the extent referenced. The publications are referenced in the text by the basic designation only. The latest version of each listed publication shall be used as a guide unless the authority having jurisdiction has adopted an earlier version.
 - 1. FM Global (Factory Mutual (FM)):FM Approval Guide
 - 2. National Fire Protection Association (NFPA)
 - a. NFPA 70 National Electrical Code
 - b. NFPA 72 National Fire Alarm Code
 - c. NFPA 90A Standard For The Installation of Air Conditioning and Ventilating Systems
 - d. NFPA 101 Life Safety Code
 - 3. Underwriters' Laboratories, Inc. (UL) equipment standards, Latest Edition
 - a. UL Fire Protection Equipment Directory
 - b. UL Electrical Construction Materials Directory
 - c. UL 38 Manually Actuated Signaling Boxes for Use With Fire Protection Signaling Systems
 - d. UL 228 Door Holding Devices
 - e. UL 268 Smoke Detectors for Fire Protective Signaling Systems
 - f. UL 268A Smoke Detectors for Duct Application

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- g. UL 464 Audible Signal Appliances
- h. UL 497A Secondary Protectors for Communications Circuits
- i. UL 521 Heat Detectors for Fire Protective Signaling Systems
- j. UL 864 Control Units for Fire Protective Signaling Systems
- k. UL 1283 Electromagnetic Interference Filters
- 1. UL 1449 Transient Voltage Surge Suppressors
- m. UL 1971 Signaling Devices for the Hearing Impaired
- 4. International Code Council
 - a. International Building Code
 - b. International Fire Code.
- 5. State and Local Building Codes as adopted and/or amended by The Authority Having Jurisdiction, ADA, and/or State and local equivalency standards as adopted by The Authority Having Jurisdiction.
- 6. Local Fire Marshal
- 7. NY-MEA
- 8. ISO 9002
- B. Supplier Qualifications
 - 1. The manufacturer of the supplied products must utilize multi-channel product distribution on a national basis to be considered for this bid. The manufacturer must have factory branches as well as independent distributors to allow the end user with the ability to utilize factory trained and authorized competitive service providers after system installation and commissioning.
 - 2. Provide the services of a factory trained and certified representative or technician, experienced in the installation and operation of the type of system provided. The representative shall be licensed in the State if required by law.
 - 3. The technician shall supervise installation, software documentation, adjustment, preliminary testing, final testing and certification of the system. The technician shall provide the required instruction to the owner's personnel in the system operation and maintenance.
 - 4. The suppliers shall furnish evidence they have an experienced service organization, which carries a stock of spare and repair parts for the system being furnished.

- 5. The equipment supplier shall be authorized and trained by the manufacturer to calculate, design, install, test, and maintain the air sampling system and shall be able to produce a certificate stating such upon request.
- C. Installer Qualifications:
 - 1. Before commencing work, submit data showing that the manufacturer has successfully installed fire alarm systems of the same scope, type and design as specified.
 - 2. The contractor shall submit copies of all required Licenses and Bonds as required in the State having jurisdiction.
 - 3. Contractors unable to comply with the provisions of Qualification of Installers shall present proof of engaging the services of a subcontractor qualified to furnish the required services.
- D. Testing Agency Qualifications: Qualified for testing indicated.
- E. Source Limitations for fire alarm equipment: Obtain fire alarm equipment from single source.
- 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.

1.08 DELIVERY, STORAGE, AND HANDLING

- A. Deliver products to project site in original, unopened packages with intact and legible manufacturers' labels identifying product and manufacturer, date of manufacture, and shelf life if applicable.
- B. Store materials inside, under cover, above ground, and kept dry and protected from physical damage until ready for use. Remove from site and discard wet or damaged materials.

1.09 PROJECT CONDITIONS

- A. Installed products or materials shall be free from any damage including, but not limited to, physical insult, dirt and debris, moisture, and mold damage.
- B. Environmental Limitations: Do not deliver or install products or materials until spaces are enclosed and weather-tight, wet work in spaces is complete and dry, and temporary HVAC system is operating and maintaining ambient temperature and humidity conditions at occupancy levels during the remainder of the construction period.

1.10 WARRANTY

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace fire alarm equipment that fail(s) in materials or workmanship within specified warranty period.
 - 1. Warranty Period: 1 year from date of Substantial Completion.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements all equipment shall be Siemens Desigo[™] Fire Safety, Honeywell, or simplex.

2.02 CONTROL PANEL

- A. The fire alarm control panel shall be microprocessor based using multiple microprocessors throughout the system providing rapid processing of smoke detector and other initiation device information to control system output functions.
- B. There shall be a watchdog circuit, which shall verify the system processors and the software program. Problems with either the processors or the system program the panel shall activate a trouble signal, and reset the panel.
- C. The system modules shall communicate with an RS 485 network communications protocol. All module wiring shall be to terminal blocks.
- D. The system shall be capable of the following configurations. Both configurations are permitted on the same network.
 - 1. The system shall support up to 252 addressable devices, which may be divided in any ratio on one, two, three, or four separate, isolated Class B circuits.
 - 2. The system shall support two DLC of 252 addressable devices, each of which may be divided in any ratio on one, two, three, or four separate, isolated Class B circuits.
- E. The system shall be capable of supporting unshielded wiring applications.
- F. System Components:
 - 1. The System Periphery board shall be capable of 252 intelligent devices distributed between one, two, three, or four Class B SLC circuits. Any trouble on one circuit shall not affect the other circuit. This module controls the signaling from the initiation devices reporting alarms and troubles to the control panel. This module shall also provide the signaling to the field devices for the controlling the output of specific initiation devices. The on board microprocessor provides the periphery board with the ability to function even if the main microprocessor fails. LED's on the board shall provide annunciation for the following; Power, Gnd. Fault, Alarm, Trouble. This board is integral to the system. The board shall be model number FCI2016-U1.
 - 2. The system periphery board shall be capable of supporting two system drivers of 252 intelligent devices distributed between one, two, three, or four Class B SLC circuits, for a total panel capacity of 504 addressable devices. Any trouble on one circuit shall not affect the other circuit. This module controls the signaling from the initiation devices reporting alarms and troubles to the control panel. This module shall also provide the signaling to the field devices for the controlling the output of specific initiation devices. The on board microprocessor provides the periphery board with the ability to function

even if the main microprocessor fails. LED's on the board shall provide annunciation for the following: Power, Gnd. Fault, Alarm, Trouble. This board is integral to the system. The board shall be model number FCI2017-U1.

- 3. The Signal Line Circuits (SLC) shall be tested for opens, shorts and communications with all addressable devices installed before connection to the control panel. Systems without this capability shall have a test panel installed for initial testing to eliminate any possible damage short term or long term to the control panel. After initial testing replace the test panel and proceed with complete testing.
- 4. The standard Operator Interface shall have the ability to view events, acknowledge, silence, and reset the system and any networked Desigo[™] Fire Safety control panels, when configured as a global PMI.
- 5. The LED Operator Interface shall have the ability to view events, acknowledge, silence, and reset the system and any networked Desigo[™] Fire Safety control panels, when configured as a global PMI. Additionally, the operator interface provides twelve multicolored configurable LEDs for annunciating system status
- 6. The System Periphery Board shall contain 2 Class B NAC circuits rated at 3 amps each with power-limited outputs. The zones shall be isolated and independently supervised. There shall be at least 6 unique codes/signals for each circuit based on system logic. These signals shall be Temporal Code 3 (Evacuation), Steady (Such as "Recall"), Temporal Code 3 (for CO alarms), March Time 120ppm, March Time 60ppm, and March Time 30ppm. The card shall have the following LED's to provide trouble shooting and annunciation; Power, Gnd. Fault, Zone Activation or Trouble. This functionality shall be integral to the system. The card shall be model number FCI2016-U1/FCI2017-U1.
- 7. The control panel shall be equipped with four Form C relays for alarm, trouble, supervisory, and programmable output. The system shall provide the mounting of all system cards, field wiring, and panel's inter-card wiring. All power limited field wiring shall be separated from all non-power limited internal wiring. The card shall be model number FCI2016-U1/FCI2017-U1.
- G. System response time from alarm to output shall be an average of three (3) seconds.
- H. All system cards and modules shall have Flash memory for downloading the latest module firmware.
- I. Passwords:
 - 1. Technician Level Password There shall be a 4 character password that a user must enter into the control panel in order to perform such maintenance- and control-related functions at the panel as:
 - a. Arming and disarming devices.
 - b. Activating, deactivating or modifying detector ASD and sensitivity settings.
 - c. Activating and deactivating the History Log function, and deleting obsolete entries.

- d. Changing the system time and date.
- 2. Maintenance Level Password There shall be a 4 character password that a user must enter into the control panel in order to access the panel's reporting functions and walktest functions.
- 3. Acknowledge Silenceable Reset Access There shall be a key required to open a locked cabinet that a system user must use in order to acknowledge events, turn silenceable audibles and visuals on and off, and perform panel resets.
- J. Degrade Mode Alarm Activation:
 - 1. Each Desigo[™] Fire Safety panel shall operate as a stand-alone fire alarm control panel with complete functionality in the event of loss of communications with other Desigo[™] Fire Safety panels on a network.
- K. Software Modifications: The system structure and software shall place no limit on the type or extent of software modifications on-site. Modification of software shall not require power-down of the system or loss of system fire protection while modifications are being made. Systems that require the use of external programmers or change of EPROMs are not acceptable.
- L. Logic: The fire alarm system shall support generic functions that deal with binary states (True/False, high/low), and produce desired outputs from one or more binary inputs (for example, alarm outputs from detector or manual station inputs). AND, OR, NOT, Any N, Latches, Start Timer, Delay Timer, Restart Timer are generic functions. Generic functions can be used as inputs to other function. The system shall support 500 logic functions.
- M. History: The system shall store 2000 events in history. Trouble warnings will occur when the History buffer is full.

2.03 POWER SUPPLY

- A. The system Power Supply FP2011-U1 shall be a 170 Watt, 6-amp that provides 24VDC power for system operation. The power supply shall be filtered and regulated. The power supply provides power for all system operation, including signaling line circuits, notification appliance circuits, auxiliary power, battery charger, and all optional modules The power supply shall be rated for 120/240 VAC 50/60 Hz. The module shall be model number FP2011-U1
- B. The power supply provides power for all system operation, including signaling line circuits, notification appliance circuits, auxiliary power, battery charger, and all optional modules. The power supply shall be rated for 120/240 VAC 50/60 Hz. The module shall be model number FP2012-U1.
- C. The battery charger shall be able to charge the system batteries up to 100 AH batteries. Battery charging shall be microprocessor controlled and programmed to select battery sizes.
- D. Transfer from AC to battery power shall be instantaneous when AC voltage drops to a point where it is not sufficient for normal operation.

2.04 SYSTEM ENCLOSURE

- A. Provide the enclosure as specified. Provide the color as to the local AHJ requirements.
- B. Provide Black cabinet enclosure.
- C. Provide Red cabinet enclosure.

2.05 INTELLIGENT INITIATING DEVICES

- A. General
 - 1. All initiation devices shall be insensitive to initiating loop polarity. Specifically, the devices shall be insensitive to plus/minus voltage connections.
- B. Smoke Detectors Standard Addressable H-Series
 - 1. The detector shall be guaranteed in writing not to false alarm when configured by the factory trained certified technician. The detector must provide up to 11 different environmental algorithms that allow the detector to provide superior false alarm immunity without the need for additional alarm verification delays.
 - 2. The detector shall have a multicolor LED to streamline system maintenance/inspection by plainly indicating detector status as follows: green for normal operation, amber for maintenance required, red for alarm.
 - 3. The multi-criteria smoke detector shall be an intelligent digital photoelectric detector with a programmable heat detector. Detectors shall be listed for use as open area protective coverage, in duct installation and sampling assembly installation and shall be insensitive to air velocity changes. The detector communications shall allow the detector to provide alarm input to the system and alarm output from the system within four (4) seconds. So as to minimize the effort required by the installing and maintenance technician to appropriately configure the detector to ensure optimal system design, the detectors shall be programmable as application specific. Application settings shall be selected in software for a minimum of eleven environmental fire profiles unique to the devices installed location.
 - 4. The detector shall be designed to eliminate the possibility of false indications caused by dust, moisture, RFI/EMI, chemical fumes and air movement while factoring in conditions of ambient temperature rise, obscuration rate changes and hot/cold smoke phenomenon into the alarm decision to give the earliest possible real alarm condition report.
 - 5. The intelligent smoke detector shall be capable of providing three distinct outputs from the control panel. The outputs shall be from an input of smoke obscuration, a thermal condition or a combination of obscuration and thermal conditions. The detector shall be designed to eliminate calibration errors associated with field cleaning of the chamber.
 - 6. The detector shall support the use of a relay, or LED remote indicator without requiring an additional software address. Low profile, white case shall not exceed 2.5 inches of extension below the finish ceiling.

- 7. For the detector where required, there shall be available a locking kit and detector guard to prevent unauthorized detector removal.
- 8. The smoke detector shall be model number HFP-11.
- C. Heat Detectors Addressable
 - 1. Thermal Detectors shall be rated at 135 degrees fixed temperature and 15 degrees per minute rate of rise. Detectors shall be constructed to compensate for the thermal lag inherent in conventional type detectors due to the thermal mass, and alarm at the set point of 135 degrees Fahrenheit. The choice of alarm reporting as a fixed temperature detector or a combination of fixed and rate of rise shall be made in system software and be changeable at any time without the necessity of hardware replacement.
 - 2. The detectors furnished shall have a listed spacing for coverage up to 2,500 square feet and shall be installed according to the requirements of NFPA 72 for open area coverage. The thermal detector shall be model number HFPT-11.
 - 3. Model FDT421 heat detector shall have the following temperature settings:
 - a. Fixed temperature at 135°F, 145°F, 155°F, 165°F, 174°F
 - b. Rate of Rise at 15° F/min (8.3°C) at 135° F (57°C)
 - c. Rate of Rise at 15° F/min (8.3°C) at 174° F (79°C)
 - d. Low temperature warning at 40°F (4.4°C)
- D. Duct Smoke Detectors Addressable
 - 1. For duct detector applications, the smoke detector shall be an intelligent digital photoelectric detector. Detectors shall be listed for use as open area protective coverage, in duct installation and sampling assembly installation and shall be insensitive to air velocity changes.
 - 2. The detector communications shall allow the detector to provide alarm input to the system and alarm output from the system within four (4) seconds. The detector shall be mounted in a duct detector housing listed for that purpose. The duct detector shall support the use of a remote test switch, relay or LED remote indicator. The duct detector shall be supplied with the appropriate sampling tubes to fit the installation.
 - 3. Where duct detectors are exposed to the weather a weatherproof enclosure shall be available. The duct housing cover shall include a test port for functional testing of the detector without cover removal. The duct housing shall include a cover removal switch capable of indicating cover removal status to the fire alarm control panel.
 - 4. The intelligent duct detector shall be model number AD2-P Series. Where required there shall be available a duct housing with an on-board relay. Also where required, there shall be a standalone housing available with its own power supply and test/reset switch that does not require connection to a fire alarm control panel. It shall be model AD2-4W.
 - 5. Duct smoke detector housing shall allow use in duct systems with air velocity ranging from 100 to 4,000 feet per minute, within temperature ranges of 32°F to 120°F per minute, and with relative humidity ranging from 0 to 95%.

- E. Manual Pull Stations Addressable
 - 1. Provide addressable manual stations where shown on the drawings, to be flush or surface mounted as required. Manual stations shall contain the intelligence for reporting address, identity, alarm and trouble to the fire alarm control panel. The manual station communications shall allow the station to provide alarm input to the system and alarm output from the system within less than four (4) seconds.
 - 2. The manual station shall be equipped with terminal strip and pressure style screw terminals for the connection of field wiring. Surface mounted stations where indicated on the drawings shall be mounted using a manufacturer's prescribed matching red enamel outlet box.
 - 3. The double action pull station shall be model number HMS-D.
 - 4. Where required, there shall also be available pull stations with break glass, capable of explosion proof installation, capable of weatherproof installation, reset key operation, and metal housings.
- F. Addressable Interface Devices
 - 1. Addressable Interface Devices shall be provided to monitor contacts for such items as water-flow, tamper, and PIV switches connected to the fire alarm system. These interface devices shall be able to monitor a single or dual contacts. An address will be provided for each contact. Where remote supervised relay is required the interface shall be equipped with a SPDT relay rated for 4 amps resistive and 3.5 amps inductive. The addressable interface modules shall be model number HTRI Series.
 - 2. Where needed, a Conventional Zone Module shall connect to the Signal Line Circuit, which will allow the use of conventional initiation devices. This module shall have the ability to support up to 15 conventional smoke detectors and an unlimited number of contact devices. This module shall also be capable of monitoring Linear Beam detectors and conventional Flame detectors. Where required, there shall be an intrinsically safe detection solution for NEMA defined intrinsically safe installations (model DI-3IS with ISI-1) compatible with the conventional zone module. The module shall be model HZM.
 - 3. Single Device Damper Monitoring and Control: A single HTRI switch input shall be able to monitor all 3 states of a damper open, closed, and in transit. A single HTRI-R shall be able to fully control a damper (through the relay connected to the motor control) while also using its switch input for monitoring all 3 states of the damper.
 - 4. Model FCIO422 addressable input/output module shall be insensitive to polarity and shall have capability for up to 4 separate inputs (Class B) or 2 separate Class A inputs and 4 separate outputs (Class B).
 - 5. Any field modules required to monitor points outside the building (sprinkler supervisory devices, etc...) shall have surge suppression with proper grounding and cabling installed in accordance with manufacturer's instructions at the point the wiring leaves the building. All underground wiring shall be rated for wet conditions.

2.06 NOTIFICATION APPLIANCES

- A. Series ZH & ZR Strobes, Horns, Horn/Strobes
 - 1. Audible/Visual notification appliances shall be listed for indoor use, and shall meet the requirements of FCC Part 15 Class B
 - 2. Appliances shall be listed under UL Standard 1971 (Standard for Safety Signaling Devices for Hearing Impaired) and UL Standard 464 (Fire Protective Signaling)
 - 3. Appliances shall use a universal back plate, which shall allow mounting to a single-gang, double-gang, 4-inch-square, 4"-octal, or a 3-1/2"-octal backbox
 - 4. Two-wire appliance wiring shall be capable of directly connecting to the mounting back plate
 - 5. Continuity check shall occur for entire NAC circuit prior to attaching any audible / visual-notification appliances
 - 6. Dust cover shall fit and protect the mounting plate
 - 7. Dust cover shall be easily removed when the appliance is installed over the back plate
 - 8. Removal of an appliance shall result in a trouble condition by the Fire Alarm Control Panel (FACP)
 - 9. Strobe appliances shall produce a minimum flash rate of 60 flashes per minute (1 flash per second) over the Regulated Input Voltage Range, and shall incorporate a Xenon flashtube enclosed in a rugged Lexan® lens
 - 10. Strobes shall be available with two or four field-selectable settings in one unit, and shall be rated per UL 1971 for up to:
 - 11. Strobes shall operate over an extended temperature range of 32°F to 120°F (0°C to 49°C), and be listed for maximum humidity of 95% RH
 - 12. Strobe inputs shall be polarized for compatibility with standard reverse-polarity supervision of circuit wiring by a Fire Alarm Control Panel (FACP)
 - 13. Audibles and Audible/Strobe Combinations
 - a. Horns and horn / strobes shall be listed for Indoor use under UL Standard 464
 - b. Horns shall be able to produce continuous synchronized output or a temporal code-3 synchronized output
 - c. Horns shall have at least 2 sound-level settings of 90 and 95 dBA
 - d. Synchronization Modules

- e. The strobe portion, when synchronization is required, shall be compatible with DSC sync modules, FS-250 panel, FireFinder XLS panel, or PAD-3 power supply with built-in sync protocol
- 14. The strobes shall not drift out of synchronization at any time during operation
- 15. Audibles and strobes shall be able to synchronize on a 2-wire circuit with the capability to silence the audible, if required
- 16. Strobes shall revert to a non-synchronized flash-rate, if the sync module or Power Supply should fail to operate (i.e. contacts remain closed)
- 17. All notification appliances shall be listed for Special Applications: Strobes are designed to flash at 1-flash-per-second minimum over their "Regulated Input Voltage Range"

2.07 DIGITAL COMMUNICATOR

- A. The Multi-Point Digital Alarm Communicator FCA2015-U1 shall be UL864 listed to provide point identification of alarm, supervisory, security and trouble events to a Central or Remove Receiving Station. The DACT shall support the following:
 - 1. Ademco Contact ID or SIA protocol
 - 2. Ademco Contact ID selection shall provide the ability to transmit events for up to 999 individual zones
 - 3. SIA selection shall provide the ability to transmit events for up to 10000 individual points
 - 4. Programming of accounts and phone numbers
 - 5. Dual phone line interface
 - 6. Line fault monitoring.
 - 7. Automatic 24-hour test
 - 8. The DACT supports configurable alarm, alarm restoral, trouble, trouble restoral, supervisory, supervisory restoral, and reset events.
 - 9. The DACT supports Ademco Contact ID alarm event codes for general alarm, smoke detector alarm, waterflow alarm, duct alarm, and manual alarm events.
 - 10. Optionally, the DACT can be programmed to report events by event queue only.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine areas and conditions for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

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B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 INSTALLATION

- A. Perform work in accordance with the requirements of NFPA 70, NFPA 72 and NECA 1-2006, Standard of Good Workmanship in Electrical Contracting.
- B. Fasten equipment to structural members of building or metal supports attached to structure, or to concrete surfaces.
- C. In the event that limited energy cable installation is allowed, all cable runs shall be run at right angles to building walls, supported from structure at intervals not exceeding 3 feet and where installed in environmental air plenums, be rated for such use and tied/supported by components listed for environmental air plenums installation.
- D. Wiring Method: Install cables in raceways and cable trays except within consoles, cabinets, desks, and counters and except in accessible ceiling spaces and in gypsum board partitions where unenclosed wiring method may be used. Conceal raceway and cables except in unfinished spaces.
- E. Wiring Method: Conceal conductors and cables in accessible ceilings, walls, and floors where possible.
- F. Wiring within Enclosures: Bundle, lace, and train conductors to terminal points with no excess and without exceeding manufacturer's limitations on bending radii. Provide and use lacing bars and distribution spools.
- G. Provide primary power for each panel from normal/ emergency panels as indicated on the Electrical Power Plans. Power shall be 120 VAC service, transformed through a two-winding, isolation type transformer and rectified to low voltage DC for operation of all circuits and devices.

3.03 BOXES, ENCLOSURES AND WIRING DEVICES

- A. Boxes shall be installed plumb and firmly in position.
- B. Extension rings with blank covers shall be installed on junction boxes where required.
- C. Junction boxes served by concealed conduit shall be flush mounted.
- D. Upon initial installation, all wiring outlets, junction, pull and outlet boxes shall have dust covers installed. Dust covers shall not be removed until wiring installation when permanent dust covers or devices are installed.
- E. "Fire alarm system" decal or silk-screened label shall be applied to all junction box covers.

3.04 CONDUCTORS

- A. Each conductor shall be identified as shown on the drawings at each with wire markers at terminal points. Attach permanent wire markers within 2 inches of the wire termination. Marker legends shall be visible.
- B. All wiring shall be supplied and installed in compliance with the requirements of the National Electric Code, NFPA 70, Article 760, and that of the manufacturer.
- C. Wiring for strobe and audible circuits shall be a minimum 14 AWG, signal line circuits minimum 18 AWG twisted.
- D. All splices shall be made using solder-less connectors. All connectors shall be installed in conformance with the manufacturer recommendations.
- E. Crimp-on type spade lugs shall be used for terminations of stranded conductors to binder screw or stud type terminals. Spade lugs shall have upset legs and insulation sleeves sized for the conductors.
- F. The installation contractor shall submit for approval prior to installation of wire, a proposed color code for system conductors to allow rapid identification of circuit types.
- G. Wiring within sub panels shall be arranged and routed to allow accessibility to equipment for adjustment and maintenance.

3.05 DEVICES

- A. Relays and other devices to be mounted in auxiliary panels are to be securely fastened to avoid false indications and failures due to shock or vibration.
- B. Wiring within panels shall be arranged and routed to allow accessibility to equipment for adjustment and maintenance.
- C. All devices and appliances shall be mounted to or in an approved electrical box.

3.06 IDENTIFICATION

- A. Identify system components, wiring, cabling, and terminals. Comply with requirements for identification specified in Division 26 Section "Identification for Electrical Systems."
- B. Permanently label or mark each conductor at both ends with permanent alphanumeric wire markers.
- C. A consistent color code for fire alarm system conductors throughout the installation.

3.07 FIELD QUALITY CONTROL

- A. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.
- B. Testing General:
- 1. All Alarm Initiating Devices shall be observed and logged for correct zone and sensitivity. These devices and their bases shall be tagged with adhesive tags located in an area not visible when installed, showing the initials of the installing technician and date.
- 2. Wiring runs shall be tested for continuity, short circuits and grounds before system is energized. Resistance, current and voltage readings shall be made as work progresses.
- 3. The acceptance inspector shall be notified before the start of the required tests. All items found at variance with the drawings or this specification during testing or inspection by the acceptance inspector shall be corrected.
- 4. Test reports shall be delivered to the acceptance inspector as completed.
- 5. All test equipment, instruments, tools and labor required to conduct the system tests shall be made available by the installing contractor. The following equipment shall be a minimum for conducting the tests:
 - a. Ladders and scaffolds as required to access all installed equipment.
 - b. Multi-meter for reading voltage, current and resistance.
 - c. Two-way radios and flashlights.
 - d. A manufacturer recommended device for measuring air flow through air duct smoke detector sampling assemblies.
 - e. Decibel meter.
 - f. In addition to the testing specified to be performed by the installing contractor, the installation shall be subject to test by the acceptance inspector.

3.08 ACCEPTANCE TESTING

- A. A written acceptance test procedure (ATP) for testing the fire alarm system components and installation will be prepared by the engineer in accordance with NFPA 72 and this specification. The contractor shall be responsible for the performance of the ATP, demonstrating the function of the system and verifying the correct operation of all system components, circuits, and programming.
- B. A program matrix shall be prepared by the installing contractor referencing each alarm input to every output function affected as a result of an alarm condition on that input.
- C. The installing contractor prior to the ATP shall prepare a complete listing of all device labels for alphanumeric annunciator displays.
- D. Loop Resistance Tests: Measure and record the resistance of each circuit with each pair of conductors in the circuit short-circuited at the farthest point from the circuit origin. The tests shall be witnessed by the owner and test results recorded for use at the final acceptance test.

- E. Preliminary Testing: Conduct preliminary tests to ensure that all devices and circuits are functioning properly. After preliminary testing is complete, provide a letter certifying that the installation is complete and fully operable. The letter shall state that each initiating and indicating device was tested in place and functioned properly. The letter shall also state that all panel functions were tested and operated properly. The Contractor and an authorized representative from each supplier of equipment shall be in attendance at the preliminary testing to make necessary adjustments.
- F. Final Acceptance Test: Notify the owner in writing when the system is ready for final acceptance testing. Submit request for test at least 14 calendar days prior to the test date. A final acceptance test will not be scheduled until meggar test results, the loop resistance test results, and the submittals required in Part 1 are provided to the owner. Test the system in accordance with the procedures outlined in NFPA 72.
 - 1. Verify that the control unit is in the normal condition as detailed in the manufacturer's operating and maintenance manual.
 - 2. Test each initiating and indicating device and circuit for proper operation and response. Disconnect the confirmation feature for smoke detectors during tests to minimize the amount of smoke or test gas needed to activate the detector.
 - 3. Test the system for all specified functions in accordance with the contract drawings and specifications and the manufacturer's operating and maintenance manual.
 - 4. Visually inspect all wiring.
 - 5. Verify that all software control and data files have been entered or programmed into the FACP.
 - 6. Verify that Shop Drawings reflecting as-built conditions are accurate.
 - 7. Measure the current in circuits to assure that there is the calculated spare capacity for the circuits.
 - 8. Measure voltage readings for circuits to assure that voltage drop is not excessive.
 - 9. Measure the voltage drop at the most remote appliance on each notification appliance circuit.
- G. The acceptance inspector shall use the system record drawings in combination with the documents specified in this specification during the testing procedure to verify operation as programmed. In conducting the ATP, the acceptance inspector shall request demonstration of any or all input and output functions. The items tested shall include but not be limited to the following:
 - 1. System wiring shall be tested to demonstrate correct system response and correct subsequent system operation in the event of:
 - a. Open, shorted and grounded signal line circuits.

- b. Open, shorted and grounded notification, releasing circuits.
- c. Primary power or battery disconnected.
- 2. System notification appliances shall be demonstrated as follows:
 - a. All alarm notification appliances actuate as programmed
 - b. Audibility and visibility at required levels.
- 3. System indications shall be demonstrated as follows:
 - a. Correct message display for each alarm input at the control display.
 - b. Correct annunciator light for each alarm input at each annunciator and graphic display as shown on the drawings.
 - c. Correct history logging for all system activity.
- 4. System off-site reporting functions shall be demonstrated as follows:
 - a. Correct zone transmitted for each alarm input
 - b. Trouble signals received for disconnect
- 5. Secondary power capabilities shall be demonstrated as follows:
 - a. System primary power shall be disconnected for a period of time as specified herein. At the end of that period, an alarm condition shall be created and the system shall perform as specified for a period as specified.
 - b. System primary power shall be restored for forty-eight hours and system-charging current shall be normal trickle charge for a fully charged battery bank.
 - c. System battery voltages and charging currents shall be checked at the fire alarm control panel.

3.09 DOCUMENTATION

- A. System documentation shall be furnished to the owner and shall include but not be limited to the following:
 - 1. System record drawings and wiring details including one set of reproducible drawings, and a CD ROM with copies of the record drawings in DXF format for use in a CAD drafting program.
 - 2. System operation, installation and maintenance manuals.
 - 3. System matrix showing interaction of all input signals with output commands.

- 4. Documentation of system voltage, current and resistance readings taken during the installation, testing and ATP phases of the system installation.
- 5. System program showing system functions, controls and labeling of equipment and devices.

3.10 PROTECTION

A. Remove and replace devices and panel components that are wet, moisture damaged, or mold damaged.

3.11 DEMONSTRATION

- A. Instructor: Include in the project the services of an instructor, who shall have received specific training from the manufacturer for the training of other persons regarding the inspection, testing and maintenance of the system provided. The instructor shall train the employees designated by the owner, in the care, adjustment, maintenance, and operation of the fire alarm system.
- B. Training sessions shall cover all aspects of system performance, including system architecture, signaling line circuit configurations, sensor and other initiating device types, locations, and addresses, fire alarm control panel function key operation, and other functions as designated by the owner.
- C. Required Instruction Time: Provide 16 hours of instruction after final acceptance of the system. The instruction shall be given during regular working hours on such dates and times as are selected by the owner. The instruction may be divided into two or more periods at the discretion of the owner. One training session shall be videotaped by the contractor. Videotapes shall be delivered to the owner.
- D. Provide a typeset printed or typewritten instruction card mounted behind a Lexan plastic or glass cover in a stainless steel or aluminum frame. Install the frame in a conspicuous location observable from the FACP. The card shall show those steps to be taken by an operator when a signal is received as well as the functional operation of the system under all conditions, normal, alarm, supervisory and trouble. The instructions shall be approved by the owner.
- E. Comprehensive system troubleshooting training shall be provided for a single individual designated by the owner. This session shall be separate and distinct from the above described sessions.
- F. All training sessions shall be conducted following final system certification and acceptance. Three additional training sessions shall be provided for all security personnel on all shifts six months after final system certification.
- G. All training sessions shall be conducted by an authorized fire alarm system distributor representative, who has received specific training from the manufacturer for the training of other persons regarding the inspection, testing, and maintenance of the system provided.

END OF SECTION